United States Department of Agriculture

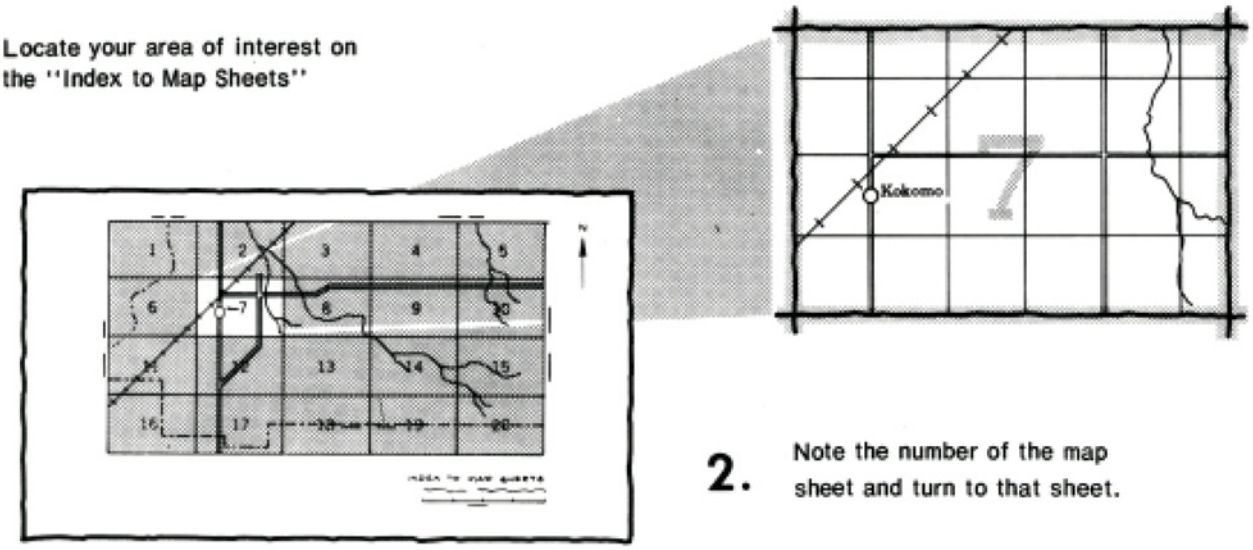
Soil Conservation Service

In cooperation with United States Department of Agriculture, Forest Service, and South Dakota Agricultural Experiment Station

Soil Survey of Jackson County, Northern Part, South Dakota

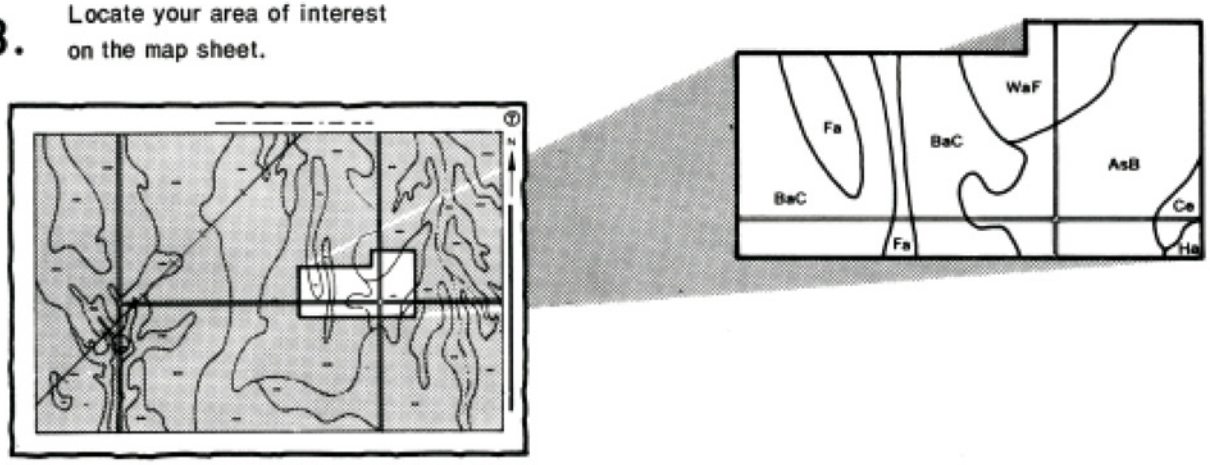
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

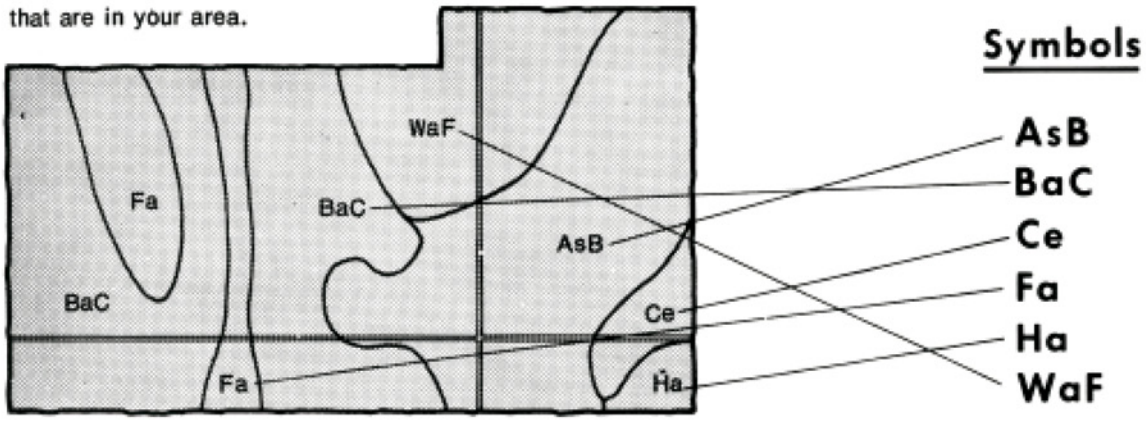


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

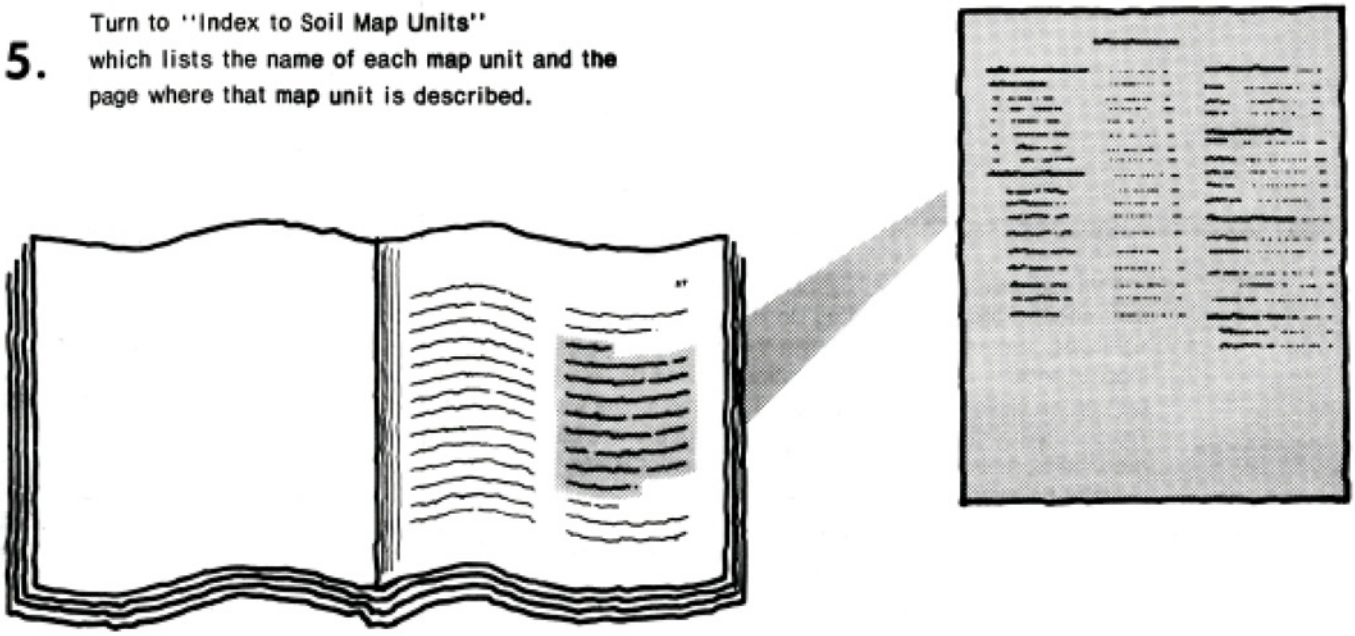


4. List the map unit symbols that are in your area.

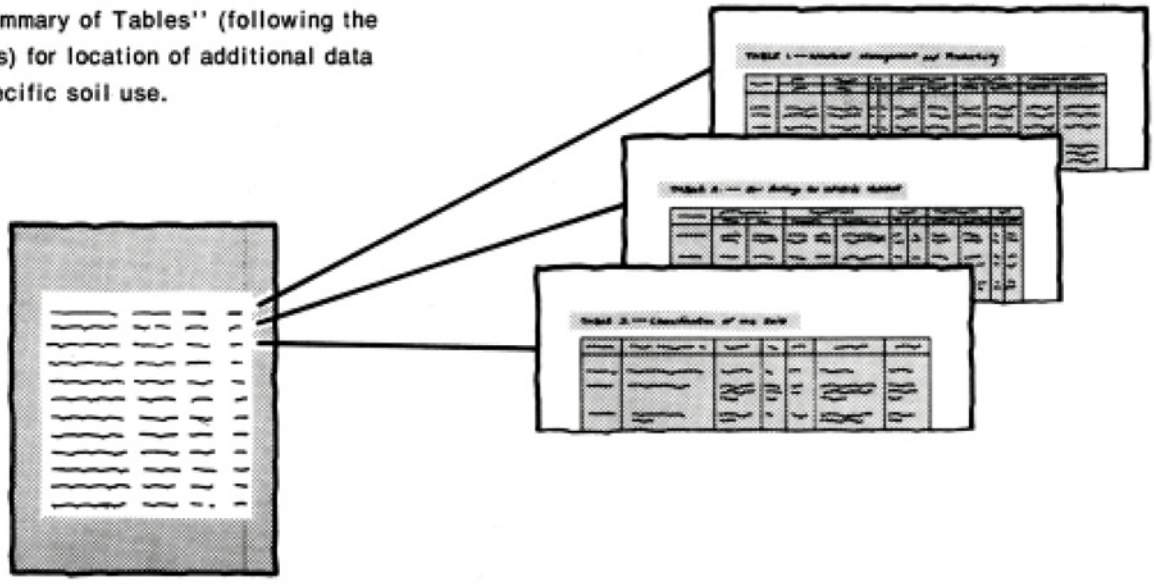


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Jackson-Washabaugh Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue, the Jackson County Commissioners, and the Old West Regional Commission.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: The Badlands in winter.

Contents

Soil Series

Issued July 1987

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Jackson County, Northern Part, South Dakota. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

R.D. Swenson
State Conservationist
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Soil Survey of Jackson County, Northern Part, South Dakota

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Fieldwork by Richard L. Schlepp, Soil Conservation Service, and
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United States Department of Agriculture, Soil Conservation Service and
Forest Service, in cooperation with the
South Dakota Agricultural Experiment Station

JACKSON COUNTY, NORTHERN PART, is in the southwestern part of South Dakota (fig. 1). The survey area has a total of 519,949 acres, which includes about 4,450 acres of water. About 121,762 acres is administered by the Forest Service and National Park Service.

According to the 1980 census, the population of the survey area is 1,531. Kadoka, the county seat and largest town, has a population of 832. It is the principal trade center for most of the people in the survey area.

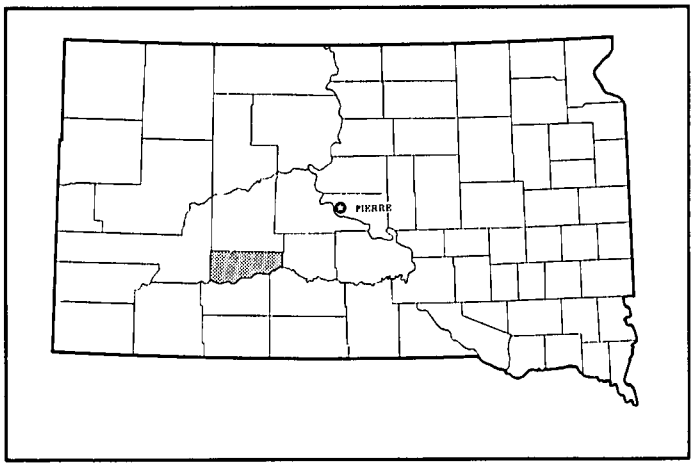

Figure 1.—Location of Jackson County, northern part, in South Dakota.

Other towns and villages include Belvidere, Cottonwood, and Interior.

Jackson County was established by an act of the Dakota Territorial Legislature in 1883 (*4*). It was named after John R. Jackson, Council Speaker from Minnehaha County, South Dakota. Prior to 1889, Jackson County was part of the Pine Ridge Indian Reservation. In 1897, the Territorial Legislature completely eliminated Jackson County by enlarging Stanley County. Seven years later the voters of Stanley County reestablished Jackson County. In 1979, the state legislature included Washabaugh County within the boundaries of Jackson County.

General Nature of the Survey Area

This section gives general information concerning the survey area. It describes climate; physiography, relief, and drainage; ranching and farming; and natural resources.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The survey area is usually quite warm in summer. Hot spells frequently occur, and cool days occasionally occur. The survey area is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls during the warm period, and rainfall is heaviest late in spring and early in summer. Snowfall is normally not too heavy, and it is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Cottonwood in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 22 degrees F, and the average daily minimum temperature is 9 degrees. The lowest temperature on record, which occurred at Cottonwood on January 19, 1970, is -34 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Cottonwood on July 4, 1952, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 16.72 inches. Of this, 13 inches, or more than 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 3.30 inches at Cottonwood on September 20, 1955. Thunderstorms occur on about 42 days each year. Hail falls in scattered small areas during some of these storms.

The average seasonal snowfall is 34 inches. The greatest snow depth at any one time during the period of record was 20 inches. On the average, 37 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 65 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the north-northwest. Average windspeed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

The survey area is in the Pierre Hills and Tertiary Table Lands division of the Great Plains (*5*). The nearly level flood plains along the White River are in the extreme southern part of the survey area. The bedrock in the southwestern part consists of the Brule and Chadron Formations of the White River Group. This part of the survey area is characterized by very steep Badland and nearly level and gently sloping alluvial fans and drainageways. The bedrock in the rest of the survey area is in the Pierre Shale Formation. A small portion of the Pierre Shale Formation in the north-central and northwestern parts of the survey area is overlain by shale of the Foxhill Formation. Loamy terraces are throughout the northern part of the survey area. They occur as mesas and tableland on the high parts of the landscape.

The northern two-thirds of the survey area is drained by the Bad River. The tributaries of this river include Big Buffalo, Brave Bull, Cottonwood, Franklin, Indian, Little Buffalo, White Water, and Willow Creeks. The southern third of the survey area is drained by the White River and its tributaries.

Elevation ranges from 2,660 feet above sea level in the western part of the survey area to 1,940 feet where the White River flows eastward out of the survey area, in the southeastern part.

Ranching and Farming

Ranching is the principal enterprise in the survey area. Beef cattle and sheep are the main types of livestock. About 68 percent of the farm income is derived from the sale of livestock and livestock products. Many of the crops are used for livestock feed. Most of the small grain is sold as a cash crop.

In 1978, the survey area had 154 ranches and farms, which averaged about 3,240 acres in size. The trend is toward fewer and larger ranches and farms. Many ranchers in the western part of the survey area lease additional grazing land from the Forest Service.

About 81 percent of the acreage in the survey area is range, and about 19 percent is used for cultivated crops and tame pasture and hay (*3*). Winter wheat is the main crop, and alfalfa is the second most common crop. Grain sorghum, sudangrass, oats, and barley also are grown.

The survey area is part of the Jackson-Washabaugh Conservation District, which was organized in 1941. This district has been instrumental in planting grasses and trees to help control erosion. The trees also provide protection for farmsteads and wildlife.

Natural Resources

Soil is the most important natural resource in the survey area. It provides a growing medium for crops and for the grasses grazed by livestock. Other natural resources are water, sand and gravel, and wildlife.

The main sources of water for livestock are stock water impoundments, dams, and shallow wells. Wells drilled to a depth of about 2,800 feet also provide water. Water quantity generally is greater in the deep wells, but the quality is poor because of a high content of soluble salts. The White River is a source of water for livestock, wildlife, and irrigation.

Significant deposits of sand and gravel are along the White River. These deposits consist mainly of very fine sand to coarse sand and gravel. Additional gravel deposits are on ridges and terrace scarps in the northern

part of the survey area. Because of an excessive amount of fine rock fragments, such as shale and chalk, the sand and gravel are unsuitable as concrete aggregate or as construction material. They are suitable, however, as subgrade material for roads and as bituminous aggregate.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of

other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Nearly Level to Very Steep, Clayey Soils on Uplands

These soils dominantly are moderately sloping to steep but are nearly level and gently sloping in some places and very steep in others. They make up about 40 percent of the survey area. About 78 percent of the acreage is range. Maintaining the most productive grasses is the main concern in managing range. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Controlling erosion and conserving moisture are the main management concerns in cultivated areas.

1. Samsil-Pierre Association

Shallow and moderately deep, well drained, moderately sloping to very steep, clayey soils on uplands

This association is on breaks along the major drainageways. The landscape is characterized by steep slopes and deeply entrenched drainageways. The soils generally are steep and moderately steep but are very steep along some drainageways and moderately sloping on some ridges. The drainage pattern is well defined. Scattered stones are on some of the ridges.

This association makes up about 14 percent of the survey area. It is about 65 percent Samsil soils, 30 percent Pierre soils, and 5 percent minor soils (fig. 2).

The shallow Samsil soils are on the upper side slopes and ridges. Slopes range from 6 to 45 percent. Typically, the surface layer is grayish brown clay. The underlying material is light brownish gray, calcareous shaly clay. Light olive gray, calcareous shale is at a depth of about 11 inches.

The moderately deep Pierre soils are on the mid and lower side slopes. In this association they generally have a slope of 6 to 25 percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown and pale olive clay. The underlying material is pale olive shaly clay. The soils are calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches.

Minor in this association are the Hisle, Hurley, Nihill, and Wendte soils. The sodium affected Hisle and Hurley soils are on foot slopes adjacent to drainageways. The gravelly Nihill soils are on ridges. The stratified Wendte soils are on narrow flood plains.

Nearly all of this association supports native grasses and is used for grazing. Controlling erosion and maintaining the most productive grasses are the main management concerns. The major soils are suited to range and to rangeland wildlife habitat. They generally are unsuited to cultivated crops and to tame pasture and hay because of the slope. Landslides are common because of the slope and the unstable nature of the underlying shale.

2. Pierre-Kyle Association

Moderately deep and deep, well drained, nearly level to moderately sloping, clayey soils on uplands

This association is on uplands characterized by low ridges and shallow drainageways. Slopes generally are gently sloping but are steeper on some ridges and nearly level in other areas. The drainage pattern is well defined.

This association makes up about 2 percent of the survey area. It is about 50 percent Pierre soils, 40 percent Kyle soils, and 10 percent minor soils.

The moderately deep Pierre soils are on the upper side slopes and ridges. In this association they have a slope of 2 to 9 percent. Typically. the surface layer is grayish brown clay. The subsoil is grayish brown and pale olive clay. The underlying material is pale olive shaly clay. The soils are calcareous throughout. Pale

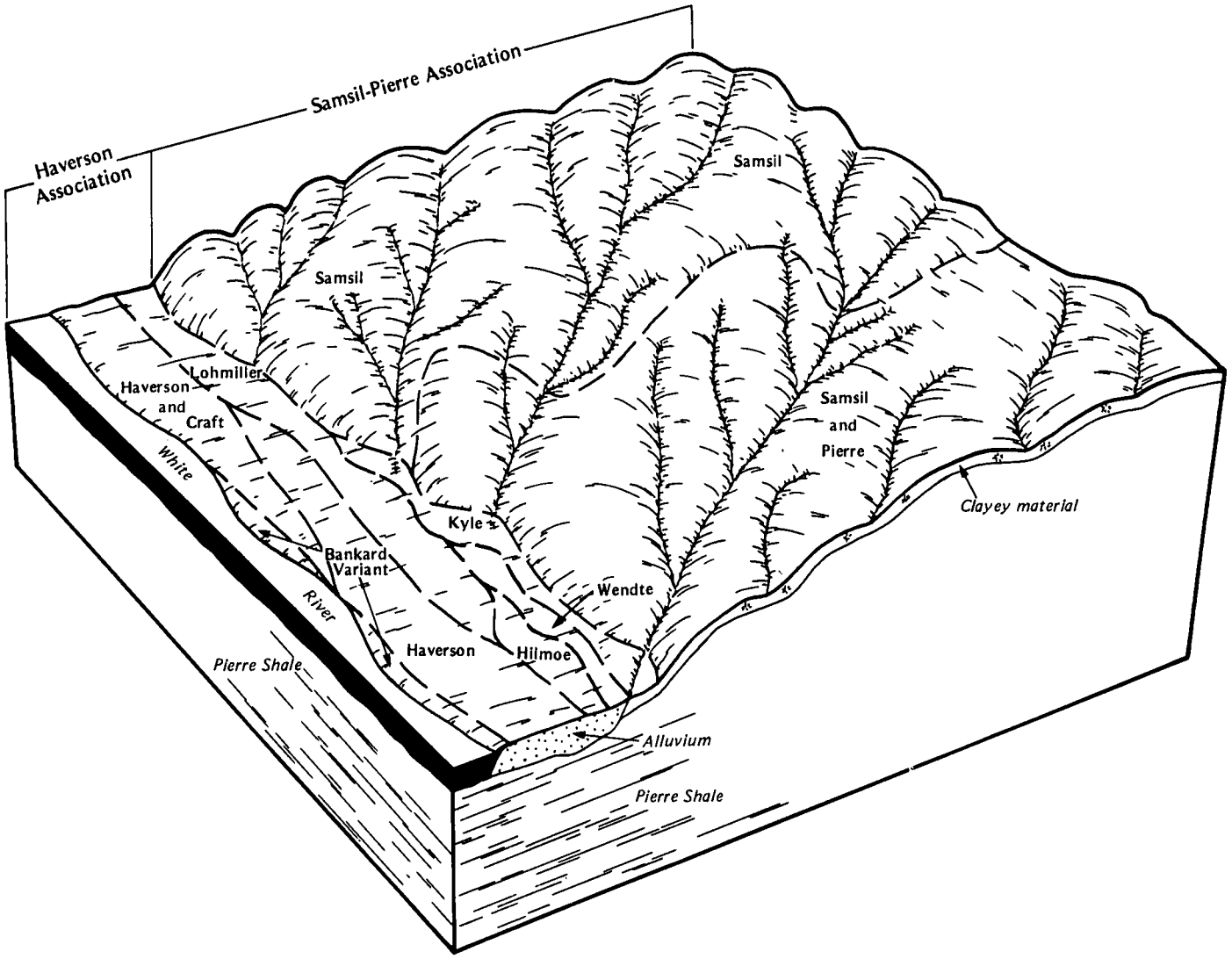

Figure 2.—Pattern of soils and underlying material in the Samsil-Pierre and Haverson associations.

yellow and gray, calcareous shale is at a depth of about 37 inches.

The deep Kyle soils are on smooth side slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown, calcareous clay. The underlying material is olive, calcareous clay.

Minor in this association are the Arvada, Hisle, and Samsil soils. The sodium affected Arvada and Hisle soils are along drainageways and on low side slopes. The shallow Samsil soils are on ridges.

About 50 percent of this association is range. Maintaining the most productive grasses is the main concern in managing range. Small grain, grain sorghum, and alfalfa are the main crops. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing cultivated areas. The major soils are suited to range, rangeland and openland wildlife habitat, tame pasture and hay, and cultivated crops.

3. Pierre-Promise Association

Moderately deep and deep, well drained, nearly level to strongly sloping, clayey soils on uplands

This association is on uplands characterized by low ridges and shallow drainageways. Slopes generally are nearly level to moderately sloping but are strongly sloping along some drainageways. The drainage pattern is well defined.

This association makes up about 24 percent of the survey area. It is about 45 percent Pierre soils, 30 percent Promise soils, and 25 percent minor soils (fig. 3).

The moderately deep Pierre soils are on ridges and the upper side slopes. In this association they generally have a slope of 2 to 15 percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown and pale olive clay. The underlying material is pale olive shaly clay. The soils are calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches.

The deep Promise soils generally are on the mid and lower side slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray clay. The subsoil is dark grayish brown, grayish brown, and light brownish gray, calcareous clay. The underlying material is light brownish gray, calcareous clay.

Minor in this association are the Arvada, Hurley, Kolls, Nunn, Samsil, and Wendte soils. The sodium affected Arvada and Hurley soils are along small drainageways and on low side slopes. The poorly drained Kolls soils are in depressions. The loamy Nunn soils are higher on the landscape than the Pierre soils. The shallow Samsil soils are on ridges. The stratified Wendte soils are on narrow flood plains.

About 70 percent of this association is range. Maintaining the most productive grasses is the main concern in managing range. Small grain, grain sorghum, and alfalfa are the main crops. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing cultivated areas. The major soils

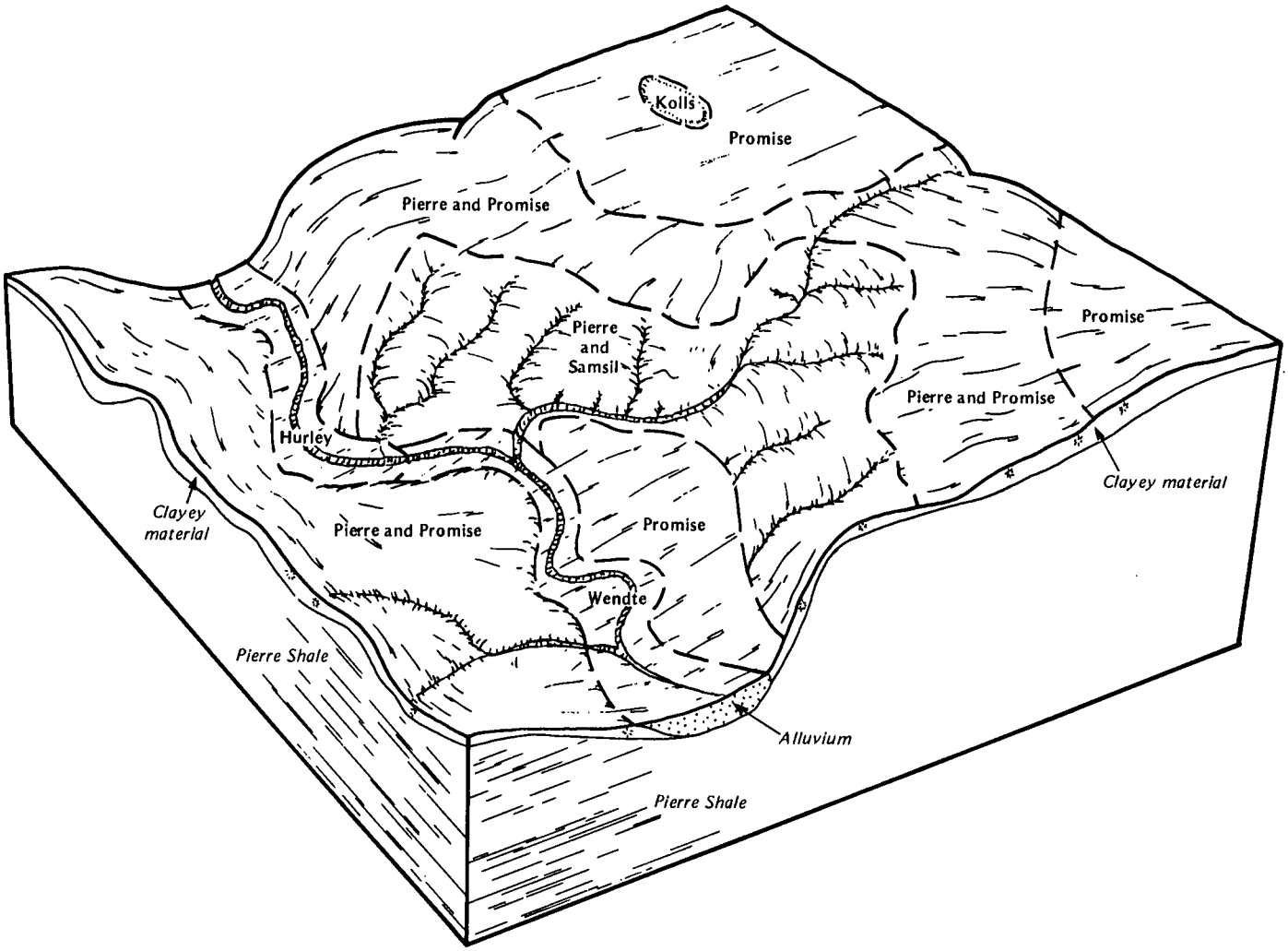

Figure 3.—Pattern of soils and underlying material in the Pierre-Promise association.

are suited to range, rangeland and openland wildlife habitat, tame pasture and hay, and cultivated crops.

Nearly Level, Loamy and Silty Soils on Terraces and Flood Plains

These soils make up about 6 percent of the survey area. About 65 percent of the acreage is range. Maintaining the most productive grasses is the main concern in managing range. Grain sorghum, sudangrass, and alfalfa are the main crops. Conserving moisture, controlling erosion, and improving tilth and fertility are the main concerns in managing cultivated areas.

4. Haverson Association

Deep, well drained, nearly level, loamy soils on flood plains

This association is on flood plains along the major drainageways. Narrow, low ridges and oxbows characterize some areas. The soils are subject to flooding when ice dams the river and after intense rainfall. The flooding usually is of short duration.

This association makes up about 3 percent of the survey area. It is about 40 percent Haverson soils and 60 percent minor soils (fig. 2).

Haverson soils have a slope of 0 to 2 percent. Typically, the surface layer is light brownish gray, calcareous loam. The upper part of the underlying material is light gray and light brownish gray, calcareous, stratified loam, silt loam, and clay loam. The lower part is light gray, calcareous fine sand.

Minor in this association are the Bankard Variant, Craft, Hilmoe, Kyle, Lohmiller, and Wendte soils. Bankard Variant soils are underlain by gravelly sand. They are adjacent to the river. Craft soils contain less clay in the control section than the Haverson soils. Craft soils and the clayey Hilmoe and Lohmiller soils are in positions on the landscape similar to those of the Haverson soils. The clayey Kyle and Wendte soils are adjacent to the uplands.

About 60 percent of this association is cropland. Small grain, sudangrass, grain sorghum, and alfalfa are the main crops. Conserving moisture, improving fertility, and controlling wind erosion are the main concerns in managing the major soils for cultivated crops. Small isolated areas near the river support native grasses and are used for grazing. The major soils are suited to range, rangeland wildlife habitat, tame pasture and hay, cultivated crops, and openland wildlife habitat. The trees and shrubs near the channel provide excellent cover for wildlife and livestock.

5. Interior-Absted Association

Deep, well drained, nearly level, loamy and silty soils on terraces and flood plains

This association is on flood plains and terraces that are generally dissected by meandering stream channels. It makes up about 3 percent of the survey area. It is about 40 percent Interior soils, 30 percent Absted soils, and 30 percent minor soils.

Interior soils are on flood plains near the stream channel. They have a high content of sodium. Slopes range from 0 to 3 percent. Typically, the surface layer is light gray, calcareous loam. The underlying material is light gray and white, calcareous, stratified loam, silt loam, and silty clay loam.

The sodium affected Absted soils are on low terraces near the adjoining uplands. Slopes range from 0 to 3 percent. Typically, the surface layer is light gray silt loam. The subsoil is grayish brown and light brownish gray silty clay. The underlying material is light gray and light brownish gray, calcareous silty clay loam and silty clay.

Minor in this association are the clayey Cactusflat, Kyle, Lohmiller, Promise, and Wendte soils. Cactusflat, Kyle, and Promise soils are on uplands. Lohmiller and Wendte soils are in positions on the landscape similar to those of the Interior soils.

About 90 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. In some areas the Absted soils are cultivated. Winter wheat, oats, sudangrass, grain sorghum, and alfalfa are the main crops. Conserving moisture and improving tilth and fertility are the main concerns in managing cultivated areas. The high content of sodium in these soils also is a concern. The Absted soils are suited to cultivated crops and to tame pasture and hay, but the Interior soils generally are unsuited. Both soils are suited to range and rangeland wildlife habitat.

Badland and Nearly Level to Strongly Sloping, Silty, Loamy, and Clayey Soils on Uplands, Fans, and Flood Plains

These areas dominantly are gently sloping or moderately sloping but are steeper along drainageways and are nearly level in places. The soils and the Badland make up about 27 percent of the survey area. The Badland generally forms the "Wall" of the Badlands. About 96 percent of the acreage is range. Controlling erosion and maintaining the most productive grasses are the main concerns in managing range. A few areas are used for alfalfa or small grain.

6. Weta-Cactusflat Association

Deep, well drained, nearly level and gently sloping, silty and clayey soils on uplands and fans

This association is in broad basins on uplands that are dissected by small drainageways. Slopes generally are nearly level but are gently sloping in some areas. The drainage pattern is well defined in most areas.

This association makes up about 4 percent of the survey area. It is 50 percent Weta soils, 45 percent Cactusflat soils, and 5 percent minor soils (fig. 4).

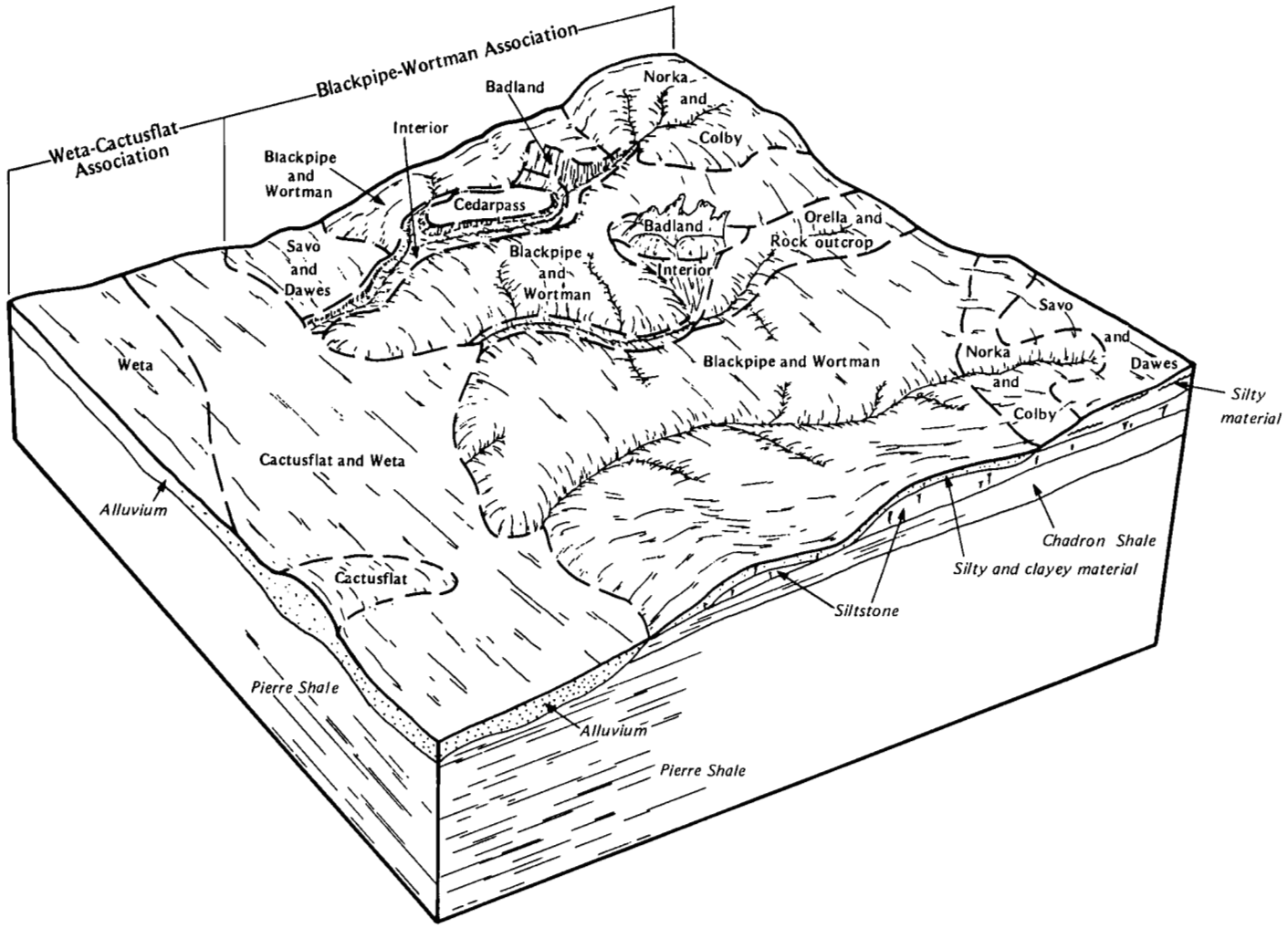

Figure 4.—Pattern of soils and underlying material in the Weta-Cactusflat and Blackpipe-Wortman associations.

The sodium affected Weta soils are in smooth areas. Slopes range from 0 to 6 percent. Typically, the surface layer is light brownish gray silt loam. The subsoil is dark gray, gray, light gray, and light brownish gray silty clay and silty clay loam. In the lower part it is calcareous and has salts. The underlying material is light gray, calcareous, stratified silty clay loam and silt loam.

Cactusflat soils generally are on the higher parts of the landscape. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay. The subsoil is grayish brown, light brownish gray, and pale brown, calcareous silty clay. The underlying material is light gray and very pale brown, calcareous, stratified silty clay loam and clay loam.

Minor in this association are the Arvada, Interior, Metre, and Norka soils. Arvada soils are not so dark as the Weta soils. They are in small depressions. The stratified Interior soils are on flood plains. The moderately deep Metre soils and the silty Norka soils do not have a sodium affected subsoil. They are on the high parts of the landscape.

About 90 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. Some areas are used as cropland. Small grain and grain sorghum are the main crops. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing cultivated areas. The sodium affected subsoil in the Weta soils also is a concern. This association is suited to cultivated crops, tame pasture and hay, openland and rangeland wildlife habitat, and range.

7. Blackpipe-Wortman Association

Moderately deep, well drained, gently sloping and moderately sloping, silty soils on uplands

This association is on uplands characterized by ridges and valleys. Slopes generally are moderately sloping but are gently sloping in some areas. The drainage pattern is well defined.

This association makes up about 5 percent of the survey area. It is about 30 percent Blackpipe soils, 20 percent Wortman soils, and 50 percent minor soils (fig. 4).

Blackpipe soils are on the upper side slopes and ridges. Slopes range from 3 to 9 percent. Typically, the surface layer is gray silt loam. The subsoil is dark grayish brown, grayish brown, and light gray silty clay loam and silty clay. It is calcareous in the lower part. Light gray and white, calcareous siltstone is at a depth of about 37 inches.

The sodium affected Wortman soils are on low side slopes. Slopes range from 2 to 9 percent. Typically, the surface layer is grayish brown silt loam. The subsurface layer is grayish brown loam. The subsoil is grayish brown and light brownish gray clay and silty clay loam. In the lower part it is calcareous and has salts. Light gray, calcareous siltstone is at a depth of about 31 inches.

Minor in this association are the Cactusflat, Cedarpass, Colby, Dawes, Interior, Norka, Norrest, Orella, Savo, Wanblee, and Weta soils and areas of Badland and Rock outcrop. Badland consists of escarpments and low mounds of exposed bedrock. The deep, clayey Cactusflat soils are in broad basins. The deep Cedarpass soils are on small mesas. The deep, silty Colby, Dawes, Norka, and Savo soils are higher on the landscape than the Blackpipe soils. The deep, stratified Interior soils are along drainageways. Norrest soils have a surface layer that is not so dark as that of the Blackpipe soils. They occur as scattered areas throughout the association. The shallow Orella soils are on the steeper slopes. Wanblee and Weta soils are in small depressions. Wanblee soils have a surface layer that is not so dark or so thick as that of the Wortman soils. The deep Weta soils have a surface layer that is thinner than that of the Wortman soils.

About 95 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. A few areas are cultivated. Small grain and alfalfa are the main crops. Conserving moisture and controlling erosion are the main concerns in managing cultivated areas. The sodium affected subsoil in the Wortman soils also is a concern. The major soils are suited to cultivated crops, range, tame pasture and hay, and openland and rangeland wildlife habitat.

8. Norrest-Cedarpass-Interior Association

Moderately deep and deep, well drained, nearly level to moderately sloping, silty and loamy soils on uplands, fans, and flood plains

This association is on upland plateaus dissected by drainageways. It is below the "Wall" of the Badlands. Slopes generally are gently sloping and moderately sloping but are steeper near the higher ridges and entrenched drainageways and are nearly level in some areas. The drainage pattern is well defined.

This association makes up about 5 percent of the survey area. It is about 25 percent Norrest soils, 20 percent Cedarpass soils, 20 percent Interior soils, and 35 percent minor soils.

Norrest soils are in convex areas. Slopes range from 2 to 9 percent. Typically, the surface layer is grayish brown, calcareous silt loam. The subsoil is light brownish gray and light gray, calcareous silty clay loam and silty clay. Light gray, calcareous siltstone is at a depth of about 28 inches.

Cedarpass soils are on small mesas. Slopes range from 0 to 6 percent. Typically, the surface layer is brown silt loam. The subsoil is light brownish gray, very pale brown, and pale brown, calcareous silty clay loam and silt loam. The underlying material is very pale brown and light brownish gray, calcareous, stratified silty clay loam, very fine sandy loam, loam, and silt loam.

Interior soils are on flood plains and fans. Slopes range from 0 to 3 percent. Typically, the surface layer is light gray, calcareous loam. The underlying material is light gray and white, calcareous, stratified silt loam, loam, and silty clay loam.

Minor in this association are the Blackpipe, Denby, Orella, Wanblee, Whitewater, and Wortman soils and Badland. Badland consists of escarpments and low mounds of exposed bedrock. The moderately deep Blackpipe soils have a dark surface layer. They are in positions on the landscape similar to those of the Norrest soils. The clayey Denby soils are slightly lower on the landscape than the Cedarpass soils. The shallow Orella soils are on the steeper slopes. The moderately deep Wanblee and Wortman soils have a sodium affected subsoil. They occur as areas intermingled with areas of the Norrest soils. The moderately deep, clayey Whitewater soils are in positions on the landscape similar to those of the Norrest soils.

About 95 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. Small grain is the main crop. Conserving moisture, improving tilth, and controlling erosion are the main concerns in managing cultivated areas. The association is suited to tame pasture and hay, range, and rangeland wildlife. Much of the association is suited to cultivated crops, but it is unlikely that many crops will be grown because ranching is preferred. Part of the association is in the Badlands National Monument.

9. Badland-Interior-Cedarpass Association

Badland and deep, well drained, nearly level and gently sloping, loamy and silty soils on uplands, fans, and flood plains

This association is on uplands characterized by rock outcrop and pedisediment slopes dissected by many drainageways. It also is on flood plains. Slopes generally are nearly level but are gently sloping in the pediment areas and are nearly vertical in some of the outcrop areas. Differences in elevation in the outcrop areas are as much as 250 feet. The Badland rock outcrop is known locally as the "Wall."

This association makes up about 6 percent of the survey area. It is about 30 percent Badland, 25 percent Interior soils, 20 percent Cedarpass soils, and 25 percent minor soils.

Badland occurs as escarpments several hundred feet high, as low mounds, and as steep spires. It consists of the raw exposures of bedrock of the Brule, Chadron, and Pierre Formations and the unvegetated sides of drainageways and small pedestals.

Interior soils are on flood plains and at the base of the areas of Badland. Slopes range from 0 to 3 percent. Typically, the surface layer is light gray, calcareous loam. The underlying material is light gray and white, calcareous, stratified silt loam, loam, and silty clay loam.

Cedarpass soils are on small mesas and pediment slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is brown silt loam. The subsoil is light brownish gray, pale brown, and very pale brown, calcareous silty clay loam and silt loam. The underlying material is very pale brown and light brownish gray, calcareous, stratified silty clay loam, very fine sandy loam, loam, and silt loam.

Minor in this association are the Blackpipe, Denby, Norrest, Orella, Wanblee, Whitewater, and Wortman soils. The moderately deep Blackpipe and Wortman soils have a dark surface layer. They generally are on the high parts of the landscape above the Badland. The clayey Denby soils are slightly lower on the landscape than the Cedarpass soils. The moderately deep Norrest and Whitewater soils are higher on the landscape than the Cedarpass soils. The shallow Orella soils are on the steeper slopes. The moderately deep, sodium affected Wanblee soils are in small depressions.

Nearly all of the acreage supports native grasses and is used for grazing. Controlling runoff and maintaining the most productive grasses are the main concerns in managing range. This association is generally unsuited to cultivated crops and to tame pasture and hay. The high content of sodium in the Interior soils, the rock outcrops, and the inaccessibility of many areas of the Cedarpass soils are limitations. The many areas of Badland divide the soils into many small tracts that are inaccessible to modern farm machinery. The association is suited to range, rangeland wildlife habitat, and recreational uses. Part of the association is in the Badlands National Monument.

10. Hisle-Larvie Association

Moderately deep, well drained, nearly level to strongly sloping, silty and clayey soils on uplands

This association is on uplands characterized by broad flats that are interrupted by ridges and drainageways. Slopes generally are gently sloping but are nearly level in some areas and are moderately sloping or strongly sloping on some ridges and on the sides of drainageways. The drainage pattern is well defined.

This association makes up about 7 percent of the survey area. It is about 45 percent Hisle soils, 30 percent Larvie soils, and 25 percent minor soils.

Hisle soils are on short, concave side slopes and in shallow depressions. Slopes range from 0 to 9 percent. Typically, the surface layer is grayish brown silt loam. The subsoil is grayish brown and light brownish gray clay. In the lower part it has visible salts and is calcareous. The underlying material is pale olive clay and shaly clay. It has visible salts and is calcareous. Light gray, calcareous shale is at a depth of about 26 inches.

Larvie soils are in smooth, convex areas. Slopes range from 2 to 15 percent. Typically, the surface layer is dark brown, calcareous clay. The subsoil is weak red, calcareous clay. Weak red, calcareous shale is at a depth of about 26 inches.

Minor in this association are the Arvada, Conata, Interior, Kyle, Metre, Orella, and Whitewater soils and Badland and Slickspots. The deep Arvada and Interior soils are along drainageways and on fans. Badland consists of escarpments and low mounds of exposed bedrock. The shallow Conata and Orella soils are on ridges. Kyle, Metre, and Whitewater soils are in positions on the landscape similar to those of the Larvie soils. Kyle soils are more than 40 inches deep over bedrock. Metre soils have a dark surface layer. Whitewater soils formed in sodium-rich material weathered from clay shale. Slickspots are in positions on the landscape similar to those of the Hisle soils. They consist of small areas of highly dispersed, massive clay that does not support vegetation.

Nearly all of the acreage supports native grasses and is used for grazing. Conserving moisture, controlling erosion, and maintaining the most productive grasses are the main concerns in managing range. The Larvie soils are suited to cultivated crops and to tame pasture and hay, but the dense, clayey subsoil is a limitation. The Hisle soils generally are unsuited to cultivated crops and to tame pasture and hay because of the sodium affected subsoil. This association is suited to range and to rangeland wildlife habitat.

Nearly Level to Steep, Clayey, Silty, and Loamy Soils on Uplands and Terraces

These soils dominantly are gently sloping or moderately sloping but are steeper in some areas and are nearly level in others. They make up about 27 percent of the survey area. About 73 percent of the acreage is range. Controlling erosion, conserving moisture, and maintaining the most productive grasses are the main concerns in managing range. Winter wheat, oats, grain sorghum, and alfalfa are the main crops.

11. Nunn-Pierre Association

Deep and moderately deep, well drained, nearly level to strongly sloping, loamy and clayey soils on terraces and uplands

This association is on terraces and uplands characterized by gentle slopes. Slopes generally are nearly level and gently sloping on the terraces and moderately sloping or strongly sloping on the lower side slopes. The drainage pattern is well defined.

This association makes up about 5 percent of the survey area. It is about 40 percent Nunn soils, 30 percent Pierre soils, and 30 percent minor soils.

The deep Nunn soils are on terraces. In this association they generally have a slope of 0 to 15 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is grayish brown and light brownish gray clay and clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous sandy clay loam.

The moderately deep Pierre soils are on the mid and lower side slopes. In this association they generally have a slope of 2 to 15 percent. Typically, the surface layer is grayish brown clay. The subsoil is grayish brown and pale olive clay. The underlying material is pale olive shaly clay. The soils are calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches.

Minor in this association are the Arvada, Beckton, Hisle, Kolls, Midway, Nihill, and Samsil soils. The sodium affected Arvada, Beckton, and Hisle soils are on foot slopes and flats. The poorly drained Kolls soils are in depressions. The shallow Midway and Samsil soils are on the upper side slopes. The gravelly Nihill soils are on ridges and terrace scarps.

About 80 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. Conserving moisture and controlling erosion are the main concerns in managing the major soils for cultivated crops. This association is suited to range, cultivated crops, tame pasture and hay, and openland and rangeland wildlife habitat.

12. Emigrant-Razor-Midway Association

Moderately deep and shallow, well drained, nearly level to steep, loamy and silty soils on uplands

This association is on uplands characterized by a well defined drainage pattern. Slopes generally are gently sloping but are nearly level in some areas and are moderately sloping to steep along some drainageways. Scattered stones are on some ridges and steep side slopes.

This association makes up about 17 percent of the survey area. It is about 35 percent Emigrant soils, 25 percent Razor soils, 20 percent Midway soils, and 20 percent minor soils.

The moderately deep Emigrant soils are on the high parts of the landscape. Slopes generally range from 0 to 15 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray clay and clay loam. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 30 inches.

The moderately deep Razor soils are on the upper side slopes and on some ridges. Slopes generally range from 2 to 15 percent. Typically, the surface layer is grayish brown silty clay loam. The subsoil is grayish brown, light yellowish brown, and light gray silty clay loam. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 33 inches.

The shallow Midway soils are on ridges and the steeper side slopes. Slopes range from 6 to 40 percent. Typically, the surface layer is light yellowish brown, calcareous silty clay loam. The underlying material is light yellowish brown, calcareous silty clay. Light gray, calcareous, sandy, silty, and clayey shale is at a depth of about 14 inches.

Minor in this association are the Arvada, Beckton, Beckton Variant, Hisle, Kolls, Kyle, Nihill, and Nunn soils. Arvada, Beckton, Beckton Variant, and Hisle soils have a sodium affected subsoil. They are on the less sloping parts of the landscape. The poorly drained Kolls soils are in closed depressions. The deep Kyle soils are on low side slopes. The gravelly Nihill soils are on ridges and terrace scarps. The deep Nunn soils are in positions on the landscape similar to those of the Emigrant soils.

About 65 percent of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. Some of the nearly level and gently sloping areas are cultivated. Conserving moisture and controlling erosion are the main concerns in managing the major soils for cultivated crops. The association is suited to range, openland and rangeland wildlife habitat, tame pasture and hay, and cultivated crops. The slope of the Razor and Midway soils is the main limitation. Trees and shrubs in the larger drainageways provide excellent cover for wildlife and livestock.

13. Nunn-Beckton-Hisle Association

Deep and moderately deep, well drained, nearly level to

moderately sloping, loamy and silty soils on uplands and terraces

This association is on the high parts of terraces and uplands. Slopes generally are nearly level and gently sloping but are steeper along some drainageways. The drainage pattern is well defined.

This association makes up about 4 percent of the survey area. It is about 30 percent Nunn soils, 20 percent Beckton soils, 20 percent Hisle soils, and 30 percent minor soils.

The deep Nunn soils are on rises. In this association they generally have a slope of 0 to 9 percent. Typically, the surface layer is dark grayish brown loam. The next layer is grayish brown clay loam. The subsoil is grayish brown and light brownish gray clay and clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous sandy clay loam.

The deep, sodium affected Beckton soils are in small depressions. Slopes generally range from 0 to 9 percent. Typically, the surface layer is grayish brown loam. The subsurface layer is light brownish gray loam. The subsoil is dark grayish brown and grayish brown clay and clay loam. In the lower part it is calcareous and has salts. The underlying material is light brownish gray, calcareous clay loam.

The moderately deep, sodium affected Hisle soils are in slight depressions on low side slopes. Slopes generally range from 0 to 9 percent. Typically, the surface layer is grayish brown silt loam. The subsoil is grayish brown and light brownish gray clay. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has salts. Light gray, calcareous shale is at a depth of about 26 inches.

Minor in this association are the Arvada, Conata, Larvie, Metre, Nihill, Pierre, and Samsil soils. The deep Arvada soils do not have so much clay in the subsoil as the Hisle soils. They are along drainageways in the uplands. The shallow, clayey Conata and Samsil soils are on ridges. The moderately deep, clayey Larvie, Metre, and Pierre soils do not have a sodium affected subsoil. They are lower on the landscape than the Nunn and Beckton soils. The gravelly Nihill soils are on high ridges.

Nearly all of this association supports native grasses and is used for grazing. Maintaining the most productive grasses is the main concern in managing range. Some of the larger, less sloping areas of the Nunn soils are cultivated. Small grain and alfalfa are the main crops. Conserving moisture and controlling erosion are the main concerns in managing the major soils for cultivated crops. The major soils are suited to range and openland and rangeland wildlife habitat. The Nunn and Beckton soils are suited to cultivated crops and tame pasture and hay, but the Hisle soils generally are unsuited because of the sodium affected subsoil.

14. Beckton-Arvada Association

Deep, well drained, nearly level and gently sloping, sodium affected, loamy soils on terraces and uplands

This association is on terraces and along narrow drainageways in the uplands. It is characterized by large flats dissected by narrow drainageways. Slopes generally are nearly level and gently sloping but are moderately sloping along the drainageways. The drainage pattern is poorly defined where the drainageways terminate in shallow depressions.

This association makes up about 1 percent of the survey area. It is about 45 percent Beckton soils, 45 percent Arvada soils, and 10 percent minor soils.

Beckton soils are on the convex parts of the landscape. In this association they generally have a slope of 0 to 6 percent. Typically, the surface layer is grayish brown loam. The subsurface layer is light brownish gray loam. The subsoil is dark grayish brown and grayish brown clay and clay loam. In the lower part it is calcareous and has salts. The underlying material is light brownish gray, calcareous clay loam.

Arvada soils are in shallow depressions and other concave areas. Slopes range from 0 to 2 percent. Typically, the surface layer is light brownish gray loam. The subsoil is light brownish gray and light gray clay loam and clay. In the lower part it has visible salts and is calcareous. The underlying material is light gray and white, calcareous clay and silty clay loam.

Minor in this association are the Beckton Variant, Emigrant, Kolls, Nunn, and Razor soils. The moderately deep Beckton Variant soils are in positions on the landscape similar to those of the Beckton soils. Emigrant, Nunn, and Razor soils do not have a sodium affected subsoil. They are on the high parts of the landscape. The poorly drained Kolls soils are in depressions.

About 60 percent of this association is cropland. Some areas are used as range. Small grain, sudangrass, and grain sorghum are the main crops. Conserving moisture and improving tilth are the main concerns in managing the major soils for crops. The major soils are suited to range and rangeland wildlife habitat. The Beckton soils are suited to tame pasture and hay and to cultivated crops, but the Arvada soils generally are unsuited because of the sodium affected subsoil.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Nunn loam, 0 to 3 percent slopes, is one of several phases in the Nunn series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Pierre-Samsil clays, 6 to 15 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badland is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ab—Absted silt loam. This deep, well drained, nearly level, sodium affected soil is on terraces. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are long and are smooth or slightly concave.

Typically, the surface layer is light gray silt loam about 3 inches thick. The subsoil is grayish brown and light brownish gray, very firm and firm silty clay about 15 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light gray and light brownish gray, calcareous silty clay and silty clay loam. It has visible salt crystals throughout. In places the upper part of the subsoil is dark grayish brown. In some areas visible salts are in the upper part of the subsoil.

Included with this soil in mapping are small areas of Cactusflat, Interior, Kyle, and Lohmiller soils. These soils make up less than 15 percent of any one mapped area. They do not have a sodium affected subsoil. Also, Interior soils are more stratified than the Absted soil. Cactusflat and Kyle soils are on the high parts of the landscape. Interior and Lohmiller soils are on flood plains.

The content of organic matter and fertility are low in the Absted soil. Tilth is poor. The sodium affected subsoil restricts root penetration. Available water capacity is moderate or high. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted

grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but the sodium affected subsoil limits productivity. Examples of suited pasture plants are alfalfa, pubescent wheatgrass, intermediate wheatgrass, green needlegrass, and western wheatgrass. This soil becomes compacted if tilled when wet and is difficult to till when dry. Measures that conserve moisture and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling increases the rate of water intake and improves tilth.

This soil is suited to windbreaks and environmental plantings, but the claypan subsoil severely limits root penetration. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IVs-2; Claypan range site; windbreak suitability group 9.

Ar—Arvada loam. This deep, well drained, nearly level, sodium affected soil is along drainageways on uplands. It is subject to rare flooding of brief duration. Slopes are short and concave. Areas are elongated and 10 to several hundred acres in size.

Typically, the surface layer is light brownish gray loam about 2 inches thick. The subsoil is about 25 inches thick. It is light brownish gray and light gray, very firm and firm clay loam and clay. In the lower part it has visible salts and is calcareous. The underlying material to a depth of 60 inches is light gray and white, calcareous clay and silty clay loam. It has visible salts throughout. In places shale is at a depth of 20 to 40 inches. In some areas the surface layer and upper part of the subsoil are dark grayish brown. In other areas the subsoil has a lower content of salts.

Included with this soil in mapping are small areas of Kyle and Nunn soils. These soils make up less than 15 percent of any one mapped area. They have a lower content of sodium salts in the subsoil than the Arvada soil. Also, they are slightly higher on the landscape.

The content of organic matter and fertility are low in the Arvada soil. Tilth is poor. The sodium affected subsoil restricts root penetration. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense claypan subsoil and the high content of salts in the subsoil are limitations.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

As—Arvada-Slickspots complex. This map unit occurs as areas of a deep, well drained, nearly level, sodium affected Arvada soil intermingled with Slickspots. The unit is along upland drainageways and is subject to rare flooding of brief duration. The Arvada soil is on slight rises. The Slickspots are in slight depressions. Areas are irregular in shape and 5 to 100 acres in size. They are 45 to 60 percent Arvada soil and 20 to 35 percent Slickspots. The Arvada soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Arvada soil is light brownish gray loam about 2 inches thick. The subsoil is about 25 inches thick. It is light brownish gray and light gray, very firm and firm clay and clay loam. In the lower part it has visible salts and is calcareous. The underlying material to a depth of 60 inches is light gray and white, calcareous clay and silty clay loam. It has visible salts throughout. In places the subsoil has a lower content of salts. In some areas shale is at a depth of 20 to 40 inches. In other areas the upper part of the subsoil is dark grayish brown or grayish brown.

Slickspots occur as puddled or crusted areas that have a nearly impervious surface. They support little or no vegetation. Salts are at or near the surface. The soil material to a depth of 60 inches is dense, massive clay.

Included with this unit in mapping are small areas of Beckton, Kyle, and Nunn soils. These included soils make up less than 20 percent of any one mapped area. They are on the high parts of the landscape adjacent to the uplands. Beckton soils have a surface layer that is thicker than that of the Arvada soil. Kyle and Nunn soils do not have a sodium affected subsoil.

The content of organic matter and fertility are low in the Arvada soil. Tilth is poor. The sodium affected subsoil restricts root penetration. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. The Slickspots generally support little or no vegetation, but they do support a sparse stand of weeds and pricklypear during wet periods.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The sodium affected subsoil of the Arvada soil and the salts in the Slickspots are limitations.

The Arvada soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or windbreak suitability group.

Ba—Badland. This map unit consists of gently sloping to nearly vertical exposures of mudstone, siltstone, and shale dissected by many intermittent drainageways (fig.

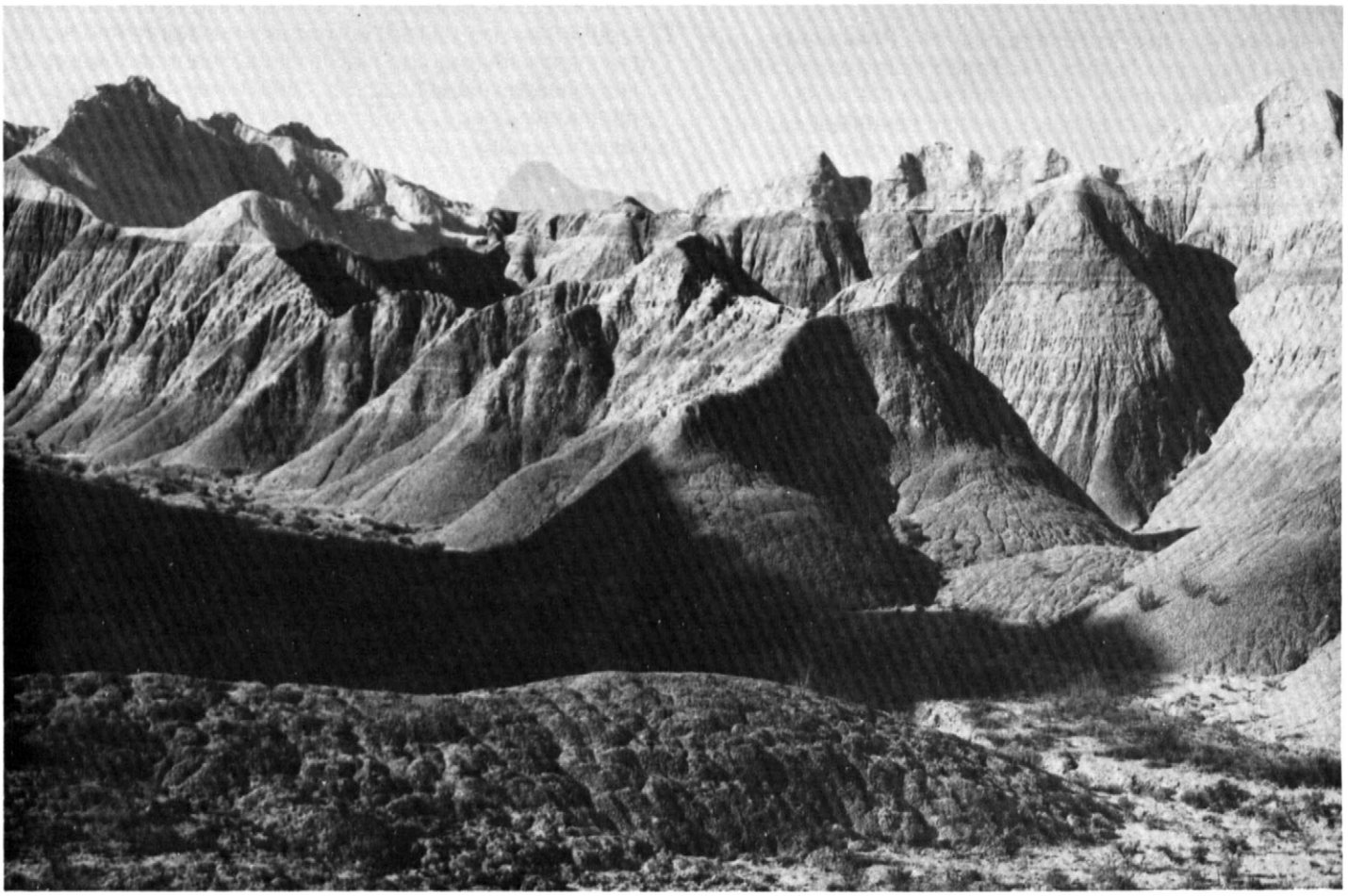

Figure 5.—An area of Badland.

5). Areas range from 10 to several thousand acres in size.

Included with the Badland in mapping are small areas of Blackpipe, Cedarpass, Hisle, Interior, Larvie, Metre, Norrest, Orella, Wanblee, and Whitewater soils. These soils make up less than 15 percent of any one mapped area. Blackpipe, Hisle, Larvie, Metre, Norrest, Orella, Wanblee, and Whitewater soils are in the less sloping vegetated areas and on some of the wider ridgetops. Cedarpass and Interior soils are near the base of the vertical exposures.

Runoff is very rapid on the Badland. This map unit is subject to severe geologic erosion. It is unsuited to cultivated crops, range, tame pasture and hay, and windbreaks and environmental plantings. Some areas where landslides have occurred support native grasses and cedar trees. These areas provide habitat for wildlife and can be used as recreational areas, such as nature trails. Cliff Shelf Nature Trail near Cedar Pass is an example.

The capability unit is VIIIs-2; no range site or windbreak suitability group is assigned.

BcB—Beckton loam, 2 to 6 percent slopes. This deep, well drained, gently sloping, sodium affected soil is on uplands and terraces. Areas are irregular in shape and 10 to several hundred acres in size.

Typically, the surface layer is grayish brown loam about 6 inches thick. The subsurface layer is light brownish gray loam about 2 inches thick. The subsoil is about 39 inches thick. It is dark grayish brown and grayish brown, very firm and firm clay and clay loam. In the lower part it is calcareous and has salts. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has visible salts throughout. In places shale is within a depth of 40

inches. In some areas the surface soil is more than 10 inches thick.

Included with this soil in mapping are small areas of Arvada, Hisle, and Nunn soils. These soils make up less than 15 percent of any one mapped area. Arvada and Hisle soils have a thin surface layer. They are in slight depressions. Nunn soils do not have a sodium affected subsoil. They are on the high parts of the landscape.

The content of organic matter is moderate and fertility medium in the Beckton soil. Tilth is poor. The sodium affected subsoil restricts root penetration. Available water capacity is moderate or high. Permeability is very slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range. Compaction can be a problem, however, if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but the sodium affected subsoil restricts crop growth. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, and western wheatgrass. Measures that conserve moisture and improve tilth are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system.

This soil is suited to windbreaks and environmental plantings, but the dense claypan subsoil and the high content of salts in the subsoil restrict growth rates. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The capability unit is IVs-2; Claypan range site; windbreak suitability group 9.

BdA—Beckton-Arvada loams, 0 to 2 percent slopes. These deep, well drained, nearly level, sodium affected soils are on uplands and terraces. The Beckton soil is in the slightly higher convex areas. The Arvada soil is in shallow depressions and other concave areas. Areas are irregular in shape and 10 to several hundred acres in size. They are 40 to 50 percent Beckton soil and 30 to 40 percent Arvada soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Beckton soil is grayish brown loam about 6 inches thick. The subsurface layer is light brownish gray loam about 2 inches thick. The subsoil is about 39 inches thick. It is dark grayish brown and grayish brown, very firm and firm clay and clay loam. In the lower part it is calcareous and has visible salts. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has visible salts throughout. In places shale is within a depth of 40 inches.

Typically, the surface layer of the Arvada soil is light brownish gray loam about 2 inches thick. The subsoil is about 25 inches thick. It is light brownish gray and light gray, very firm and firm clay and clay loam. In the lower part it has visible salts and is calcareous. The underlying material to a depth of 60 inches is light gray and white, calcareous clay and silty clay loam. It has visible salts throughout. In places the subsoil has a lower content of salts and is dark gray in the upper part. In some areas the underlying material contains more sand.

Included with these soils in mapping are small areas of Emigrant, Kolls, Nunn, and Razor soils. These included soils make up less than 20 percent of any one mapped area. They do not have a sodium affected subsoil. Emigrant and Razor soils are on the higher, more sloping parts of the landscape. Nunn soils are in positions on the landscape similar to those of the Beckton soil. Kolls soils are in depressions.

The content of organic matter is moderate in the Beckton soil and low in the Arvada soil. Fertility is medium in the Beckton soil and low in the Arvada soil. Both soils have a sodium affected subsoil that restricts the penetration of plant roots. Tilth is poor. Available water capacity is moderate or high in the Beckton soil and low or moderate in the Arvada soil. Permeability is very slow in both soils. Runoff is slow. The shrink-swell potential is high.

About half of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass. Crop growth is severely restricted on the Beckton soil because of the dense, sodium affected subsoil. No crops grow well on the Arvada soil. Measures that improve tilth and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, adding manure, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Beckton soil is suited to windbreaks and environmental plantings, but the Arvada soil generally is unsuited. The sodium affected subsoil in both soils is a limitation. Trees and shrubs can be established on the Beckton soil, but optimum survival, growth, and vigor are unlikely. No trees or shrubs grow well on the Arvada soil.

The Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9; the Arvada soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

BwC—Blackpipe-Wortman silt loams, 3 to 9 percent slopes. These moderately deep, well drained,

gently sloping and moderately sloping soils are on uplands. The Blackpipe soil is on smooth or convex slopes. The sodium affected Wortman soil is on the lower side slopes and on small flats. Areas are irregular in shape and 10 to several hundred acres in size. They are 45 to 55 percent Blackpipe soil and 25 to 35 percent Wortman soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Blackpipe soil is gray silt loam about 4 inches thick. The subsoil is about 33 inches thick. It is dark grayish brown, friable silty clay loam in the upper part; grayish brown, friable silty clay in the next part; and light gray, calcareous silty clay loam in the lower part. Light gray and white, calcareous siltstone is at a depth of about 37 inches. In places the depth to siltstone is more than 40 inches. In some areas the subsoil contains more sand. In other areas the slope is as much as 12 percent.

Typically, the surface layer of the Wortman soil is grayish brown silt loam about 3 inches thick. The subsurface layer is grayish brown loam about 2 inches thick. The subsoil is about 26 inches thick. It is grayish brown, very firm clay in the upper part and light brownish gray, firm silty clay loam in the lower part. It has accumulations of carbonates and salts in the lower part. Light gray, calcareous siltstone is at a depth of about 31 inches. In places the depth to bedrock is more than 40 inches. In some areas the subsoil contains more sand.

Included with these soils in mapping are small areas of Cactusflat, Denby, Norka, Norrest, Wanblee, and Weta soils. These included soils make up less than 20 percent of any one mapped area. Cactusflat, Denby, Norka, and Weta soils are more than 40 inches deep over bedrock. Cactusflat, Denby, and Weta soils are on the lower side slopes and along drainageways. Norka soils are on the upper side slopes and wider ridges where wind-deposited material has accumulated. Norrest and Wanblee soils have a light colored surface layer. Norrest soils are in positions on the landscape similar to those of the Blackpipe soil. Wanblee soils are in positions on the landscape similar to those of the Wortman soil.

The content of organic matter is moderate and fertility medium in the Blackpipe and Wortman soils. Tilth is good in the Blackpipe soil and poor in the Wortman soil. The Wortman soil has a sodium affected subsoil that restricts root penetration. Available water capacity is low or moderate in the Blackpipe soil and low in the Wortman soil. Permeability is moderately slow in the Blackpipe soil and very slow in the Wortman soil. Runoff is medium on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing and hay. Generally, no major hazards or limitations affect the use of these soils for range; however, the Wortman soil is subject to compaction.

These soils are suited to cultivated crops and to tame pasture and hay, but the sodium affected subsoil in the Wortman soil is a limitation. Examples of suitable pasture plants are western wheatgrass, intermediate wheatgrass, green needlegrass, and alfalfa. Small grain is better suited than row crops. Measures that control water erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage. Contour farming, terraces, and grassed waterways also can help to control erosion. Chiseling and subsoiling increase the rate of water intake and improve tilth.

These soils are suited to windbreaks and environmental plantings. Optimum growth cannot be expected on the Blackpipe soil because it is somewhat droughty. Trees and shrubs do not grow well on the Wortman soil because of the sodium affected subsoil.

The Blackpipe soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 6R; the Wortman soil is in capability unit VIs-5, Claypan range site, and windbreak suitability group 9.

CaA—Cactusflat silty clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands, fans, and terraces. Areas are irregular in shape and 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown silty clay about 4 inches thick. The subsoil is about 21 inches thick. It is grayish brown, light brownish gray, and pale brown, very firm and firm, calcareous silty clay. The underlying material to a depth of 60 inches is light gray and very pale brown, calcareous, stratified silty clay loam and clay loam. In places the underlying material is silty clay or clay and contains visible salts. In some areas the upper part of the subsoil is light brownish gray or pale brown. In other areas shale is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Norka, Savo, and Weta soils. These soils make up less than 15 percent of any one mapped area. Norka and Savo soils are slightly higher on the landscape than the Cactusflat soil. Also, Norka soils contain less clay in the subsoil, and Savo soils do not have so much sodium in the subsoil and underlying material. Weta soils have a sodium affected subsoil. They are slightly lower on the landscape than the Cactusflat soil.

The content of organic matter is moderate and fertility medium in the Cactusflat soil. Tilth is poor. Available water capacity is moderate. Permeability is slow in the subsoil and moderately slow in the underlying material. Runoff is slow. The shrink-swell potential is very high in the subsoil and moderate in the underlying material.

The acreage of this soil is about equally divided between native grasses and cultivated crops. Compaction is a problem in the areas used for range.

Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but it can become compacted if farmed when wet and is difficult to till when dry. Alfalfa, green needlegrass, pubescent wheatgrass, and western wheatgrass are examples of suitable pasture plants. Winter wheat and oats are better suited than grain sorghum. Measures that improve tilth and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grass and legumes in the cropping system.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-1; Clayey range site; windbreak suitability group 4C.

CbB—Cactusflat-Weta complex, 1 to 6 percent slopes. These deep, well drained, nearly level and gently sloping soils are on uplands, fans, and terraces. The Cactusflat soil is on the smooth or slightly convex parts of the landscape. The sodium affected Weta soil is on the slightly concave parts. Areas are irregular in shape and 10 to several hundred acres in size. They are 30 to 50 percent Cactusflat soil and 30 to 50 percent Weta soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Cactusflat soil is dark grayish brown silty clay about 4 inches thick. The subsoil is about 21 inches thick. It is grayish brown, light brownish gray, and pale brown, very firm and firm, calcareous silty clay. The underlying material to a depth of 60 inches is light gray and very pale brown, calcareous, stratified silty clay loam and clay loam. In places the underlying material is silty clay or clay and contains visible salts. In some areas the upper part of the subsoil is light brownish gray or pale brown. In other areas shale is at a depth of 30 to 40 inches.

Typically, the surface layer of the Weta soil is light brownish gray silt loam about 2 inches thick. The subsoil is about 28 inches thick. It is dark gray and gray, very firm silty clay in the upper part and light gray and light brownish gray, friable, calcareous silty clay loam in the lower part. It has visible salts and accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, stratified silty clay loam and silt loam. It has accumulations of carbonates and salts in the upper part. In places the subsoil has a lower content of sodium salts. In some areas the upper part of the subsoil is light brownish gray. In other areas shale is at a depth of 30 to 40 inches.

Included with these soils in mapping are small areas of Blackpipe, Norka, and Savo soils. These included soils make up less than 20 percent of any one mapped area. Blackpipe soils are 20 to 40 inches deep over bedrock. They are on the high parts of the landscape. Norka soils have less clay in the subsoil than the Cactusflat and Weta soils. They are in convex areas above the Cactusflat and Weta soils. Savo soils do not have so much sodium in the subsoil and underlying material as the Cactusflat soil. Also, they are higher on the landscape.

The content of organic matter is moderate in the Cactusflat and Weta soils. Fertility is medium in the Cactusflat soil and low in the Weta soil. Tilth is poor in both soils. The Weta soil has a sodium affected subsoil that restricts root penetration. Available water capacity is moderate in both soils. Permeability is slow in the subsoil and moderately slow in the underlying material. Runoff is slow. The shrink-swell potential is very high in the subsoil of the Cactusflat soil and moderate in the underlying material. It is high in the subsoil of the Weta soil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. No crops grow well on the Weta soil because of the sodium affected subsoil. Alfalfa, green needlegrass, pubescent wheatgrass, intermediate wheatgrass, and western wheatgrass are the best suited pasture plants. The soils become compacted if farmed when wet and are difficult to till when dry. Measures that improve tilth and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

The Cactusflat soil is suited to windbreaks and environmental plantings, but the Weta soil generally is unsuited. The Cactusflat soil takes in water slowly and has a clayey subsoil that can restrict the penetration of plant roots. Windbreaks can be established on the Weta soil, but optimum growth is unlikely because of the sodium affected subsoil.

The Cactusflat soil is in capability unit IIIs-1, Clayey range site, and windbreak suitability group 4C; the Weta soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

CeA—Cedarpass silt loam, 0 to 3 percent slopes. This deep, well drained, sodium-rich, nearly level soil is on uplands. Areas are irregular in shape and 10 to 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is brown silt loam about 3 inches thick. The subsoil is light brownish gray, pale brown, and very pale brown, friable, calcareous silt loam

about 14 inches thick. The underlying material to a depth of 60 inches is very pale brown and light brownish gray, calcareous, stratified very fine sandy loam, silty clay loam, loam, and silt loam. In places the surface layer and the upper part of the subsoil are dark gray or dark grayish brown.

Included with this soil in mapping are small areas of Denby, Interior, and Norrest soils. These soils make up less than 15 percent of any one mapped area. Denby soils contain more clay throughout than the Cedarpass soil. Also, they are slightly lower on the landscape. Interior soils are stratified throughout. They are along drainageways. Norrest soils are 20 to 40 inches deep over bedrock. They generally are higher on the landscape than the Cedarpass soil.

The content of organic matter is moderate and fertility medium in the Cedarpass soil. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay, but the high content of lime in the surface layer adversely affects the availability of plant nutrients after the soil is plowed. The high content of sodium in the lower part of the subsoil also is a limitation. Alfalfa, green needlegrass, and pubescent wheatgrass are suitable pasture plants. Measures that control wind erosion and conserve moisture are the main management needs in cultivated areas. Examples are including grasses and legumes in the cropping system, leaving crop residue on the surface, and minimizing tillage.

This soil is suited to windbreaks and environmental plantings, but the high content of sodium in the lower part of the subsoil is a limitation. Windbreaks can be established, but optimum growth and vigor are unlikely.

The capability unit is IVe-8; Silty range site; windbreak suitability group 8.

CfA—Cedarpass-Denby complex, 0 to 4 percent slopes. These deep, well drained, nearly level and gently sloping soils are on uplands and fans. The Cedarpass soil is in smooth areas and on low ridges. The Denby soil is in smooth areas or shallow swales. Areas are elongated and 10 to several hundred acres in size. They are 40 to 60 percent Cedarpass soil and 20 to 40 percent Denby soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Cedarpass soil is brown silt loam about 3 inches thick. The subsoil is light brownish gray, pale brown, and very pale brown, friable, calcareous silt loam about 14 inches thick. The underlying material to a depth of 60 inches is very pale brown and light brownish gray, calcareous, stratified silty clay loam, very fine sandy loam, loam, and silt loam. In some places the surface layer and the upper part of the subsoil are dark gray and dark grayish brown. In other places bedrock is at a depth of 20 to 40 inches.

Typically, the surface layer of the Denby soil is light brownish gray, calcareous silty clay about 5 inches thick. The subsoil is about 22 inches thick. It is light brownish gray, firm, calcareous silty clay in the upper part and very pale brown, friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, gray, and light gray, calcareous silty clay, silty clay loam, and silt loam. In places bedrock is at a depth of 20 to 40 inches.

Included with these soils in mapping are small areas of Interior, Norrest, and Wortman soils. These included soils make up less than 20 percent of any one mapped area. Interior soils are more stratified in the upper part than the Cedarpass and Denby soils. They are along drainageways. Norrest and Wortman soils are 20 to 40 inches deep over siltstone. They generally are on the higher parts of the landscape.

The content of organic matter is moderate in the Cedarpass soil and low in the Denby soil. Fertility is medium in the Cedarpass soil and low in the Denby soil. Tilth is good in the Cedarpass soil and poor in the Denby soil. Available water capacity is moderate or high in the Cedarpass soil and moderate in the Denby soil. Permeability is moderate in the Cedarpass soil and slow in the Denby soil. Runoff is slow on both soils. The shrink-swell potential is moderate in the Cedarpass soil. It is high in the subsoil of the Denby soil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of the Cedarpass soil for range. Compaction is a problem on the Denby soil. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. Winter wheat and oats are the best suited crops. The Denby soil becomes compacted if tilled when wet and is difficult to till when dry. Measures that control wind erosion, conserve moisture, and improve tilth are the main management needs. Examples are including grasses and legumes in the cropping system, leaving crop residue on the surface, and minimizing tillage.

These soils are suited to windbreaks and environmental plantings. The high content of sodium in the subsoil of the Cedarpass soil and the clayey subsoil of the Denby soil are limitations.

The Cedarpass soil is in capability unit IVe-8, Silty range site, and windbreak suitability group 8; the Denby soil is in capability unit IVs-6, Clayey range site, and windbreak suitability group 4C.

CoD—Colby silt loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping, sodium-rich soil is on uplands. Areas are long and narrow and are 10 to 200 acres in size. Slopes are short and convex.

Typically, the surface layer is grayish brown and light gray, calcareous silt loam about 5 inches thick. The underlying material to a depth of 60 inches is gray, light gray, and light brownish gray, calcareous silt loam and silty clay loam. In some places the surface layer is dark grayish brown. In other places bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of Blackpipe, Cactusflat, Interior, Norka and Savo soils. These soils make up less than 15 percent of any one mapped area. Blackpipe, Cactusflat, and Savo soils contain more clay in the subsoil than the Colby soil. They are on the low parts of the landscape. Interior soils are stratified. They are on flood plains. Norka soils have a surface layer that is darker than that of the Colby soil. They are in the less sloping areas.

The content of organic matter and fertility are low in the Colby soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for range. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This soil generally is unsuited to cultivated crops. It is suited to tame pasture and hay and to windbreaks and environmental plantings, but the high content of lime in the surface layer adversely affects the availability of plant nutrients. Examples of suitable pasture plants are intermediate wheatgrass and pubescent wheatgrass. Planting trees and shrubs on the contour helps to control erosion. Environmental plantings can be established, but optimum growth is unlikely.

The capability unit is VIe-3; Thin Upland range site; windbreak suitability group 8.

Cv—Craft-Bankard Variant very fine sandy loams. These deep, well drained, nearly level soils are on flood plains along the White River. The Craft soil is farther from the river than the Bankard Variant soil. It is on the low parts of the flood plains. It is subject to rare flooding. The Bankard Variant soil is on low ridges adjacent to the river. It is occasionally flooded for brief periods. Areas are irregular in shape and 20 to 100 acres in size. They are 30 to 55 percent Craft soil and 25 to 50 percent Bankard Variant soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Craft soil is light gray, calcareous very fine sandy loam about 6 inches thick. The upper 36 inches of underlying material is light gray, calcareous, stratified very fine sandy loam, loam, and loamy very fine sand. The lower part to a depth of 60 inches is light gray, calcareous, stratified fine sand and very fine sand. In places gravelly sand is below a depth of 40 inches. In some areas the underlying material contains more silt.

Typically, the surface layer of the Bankard Variant soil is light gray, calcareous very fine sandy loam about 6 inches thick. The upper 23 inches of the underlying material is very pale brown and light gray, calcareous, stratified very fine sand, loamy very fine sand, silt loam, and loamy sand. The lower part to a depth of 60 inches is multicolored gravelly sand. In places gravelly sand is at or near the surface.

Included with these soils in mapping are small areas of Haverson, Hilmoe, and Lohmiller soils. These included soils make up less than 20 percent of any one mapped area. They contain more clay between depths of 10 and 40 inches than the Bankard Variant and Craft soils. Haverson and Lohmiller soils are in positions on the landscape similar to those of the Craft soil. Hilmoe soils are in old stream channels.

The content of organic matter and fertility are low in the Bankard Variant and Craft soils. Tilth is good in both soils. Available water capacity is moderate or high in the Craft soil and low in the Bankard Variant soil. Permeability is moderate in the Craft soil and rapid in the Bankard Variant soil. Runoff is slow on both soils.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, wind erosion is a hazard if the range is overgrazed. Scattered cottonwood trees and willows provide protection for livestock and wildlife during the winter.

The Craft soil is suited to cultivated crops, but the Bankard Variant is generally unsuited. The high content of lime in the surface layer of the Craft soil adversely affects the availability of plant nutrients. The Bankard Variant soil is very susceptible to wind erosion, is occasionally flooded, and is droughty. Measures that conserve moisture and control wind erosion are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system.

These soils are suited to tame pasture and hay, but the high content of lime in the surface layer limits productivity. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and crested wheatgrass are the best suited pasture plants. A mulch of crop residue helps to control wind erosion until the pasture plants are established.

These soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs can be grown on the Craft soil. Only

evergreens can grow well on the Bankard Variant soil. Planting directly in sod without prior site preparation helps to prevent excessive wind erosion.

The Craft soil is in capability unit IIIc-2, Loamy Terrace range site, and windbreak suitability group 1; the Bankard Variant soil is in capability unit VIe-8, Sands range site, and windbreak suitability group 7.

EaB—Emigrant loam, 1 to 6 percent slopes. This moderately deep, well drained, nearly level and gently sloping soil is on uplands. Areas are irregular in shape and 10 to 300 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, grayish brown, and light brownish gray, friable and firm clay loam and clay. It is calcareous in the lower part. Light gray shale is at a depth of about 30 inches. In places the subsoil contains less sand. In some areas shale is at a depth of more than 40 inches.

Included with this soil in mapping are small areas of Arvada, Beckton Variant, Hisle, Midway, and Razor soils. These soils make up less than 20 percent of any one mapped area. Arvada, Beckton Variant, and Hisle soils have a sodium affected subsoil. They are in shallow depressions. Midway and Razor soils are on ridges. They do not have a dark surface layer. Also, Midway soils are 10 to 20 inches deep over shale.

The content of organic matter is moderate and fertility medium in the Emigrant soil. Tilth is good. Available water capacity is low. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is high.

About half the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay, but droughtiness is a limitation. Alfalfa, intermediate wheatgrass, and green needlegrass are suitable pasture plants. Measures that control erosion and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system.

This soil is suited to windbreaks and environmental plantings, but the droughtiness is a limitation. Trees and shrubs can be established, but optimum growth is unlikely.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 6R.

EbA—Emigrant-Beckton Variant loams, 0 to 2 percent slopes. These moderately deep, well drained, nearly level soils are on uplands. The Emigrant soil is on the smooth and slightly convex parts of the landscape. The sodium affected Beckton Variant soil is on the smooth or slightly concave parts. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 60 percent Emigrant soil and 25 to 40 percent Beckton Variant soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Emigrant soil is dark grayish brown loam about 5 inches thick. The subsoil is dark grayish brown and light brownish gray, friable clay loam about 19 inches thick. It is calcareous in the lower part. A 4-inch layer of white, hard limestone is at a depth of about 24 inches. It is underlain by light gray shale. In some places the surface layer contains more clay and silt. In other places the subsoil contains less clay and sand.

Typically, the surface layer of the Beckton Variant soil is grayish brown loam about 6 inches thick. The subsurface layer is gray loam about 2 inches thick. The subsoil is dark grayish brown, grayish brown, and light yellowish brown, firm and very firm clay about 16 inches thick. In the lower part it is calcareous and has visible salts. A 4-inch layer of white, hard limestone is at a depth of about 24 inches. It is underlain by light gray shale.

Included with these soils in mapping are small areas of the sodium affected Hisle soils in slight depressions. These included soils make up less than 20 percent of any one mapped area. They have a thin surface layer. Also included, on some ridges, is a soil that has bedrock within a depth of 20 inches.

The content of organic matter is moderate and fertility medium in the Beckton Variant and Emigrant soils. Tilth is good in the Emigrant soil and poor in the Beckton Variant soil. The Beckton Variant soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is low in both soils. Permeability is moderately slow in the Emigrant soil and very slow in the Beckton Variant soil. Runoff is medium on the Emigrant soil and slow on the Beckton Variant soil. The shrink-swell potential is high in both soils.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, compaction is a problem on the Beckton Variant soil. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay, but they are droughty. The layer of limestone at a depth of 20 to 30 inches limits rooting depth. Also, the dense, sodium affected subsoil in the Beckton Variant soil is a limitation. Western wheatgrass, intermediate wheatgrass, green needlegrass, and alfalfa are examples of suitable pasture plants. Small grain is better suited than row crops. Measures that conserve moisture and improve tilth are the main management

needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

These soils are suited to windbreaks and environmental plantings, but the droughtiness of the Emigrant soil and the sodium affected subsoil in the Beckton Variant soil are limitations. Trees and shrubs can be established, but optimum growth is unlikely.

The Emigrant soil is in capability unit IIIs-5, Silty range site, and windbreak suitability group 6R; the Beckton Variant soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

EbC—Emigrant-Beckton Variant loams, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are on uplands. The Emigrant soil is on the convex upper side slopes and on ridges. The sodium affected Beckton Variant soil is on the concave lower side slopes and in shallow depressions. Areas are irregular in shape and 10 to 300 acres in size. They are 40 to 60 percent Emigrant soil and 25 to 40 percent Beckton Variant soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Emigrant soil is dark grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, grayish brown, and light brownish gray, friable and firm clay loam and clay. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 30 inches. In some areas the depth to shale is more than 40 inches. In places the subsoil contains less sand.

Typically, the surface layer of the Beckton Variant soil is grayish brown loam about 6 inches thick. The subsurface layer is gray loam about 2 inches thick. The subsoil is dark grayish brown, grayish brown, light yellowish brown, and pale yellow, firm and very firm clay about 24 inches thick. In the lower part it is calcareous and has visible salts. Pale yellow, calcareous shale is at a depth of about 32 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is light brownish gray.

Included with these soils in mapping are small areas of Arvada, Hisle, Nihill, and Pierre soils. These included soils make up less than 20 percent of any one mapped area. Arvada and Hisle soils have a surface layer that is thinner than that of the Beckton Variant soil. Also, they are shallower to visible salts. They are in positions on the landscape similar to those of the Beckton Variant soil. The gravelly Nihill soils are on high ridges. Pierre soils have a light colored surface layer and contain more clay throughout than the Emigrant soil. They are on the lower side slopes.

The content of organic matter is moderate and fertility medium in the Emigrant and Beckton Variant soils. Tilth is good in the Emigrant soil and poor in the Beckton Variant soil. The Beckton Variant soil has a sodium affected subsoil that restricts root penetration. Available water capacity is low in both soils. Permeability is moderately slow in the Emigrant soil and very slow in the Beckton Variant soil. Runoff is medium on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, compaction is a problem on the Beckton Variant soil. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay, but droughtiness is a limitation. Also, the dense, sodium affected subsoil in the Beckton Variant soil is a limitation. Western wheatgrass, intermediate wheatgrass, green needlegrass, and alfalfa are suitable pasture plants. Measures that conserve moisture, control erosion, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth. Terraces and grassed waterways help to control erosion.

These soils are suited to windbreaks and environmental plantings, but the droughtiness is a limitation. The sodium affected subsoil in the Beckton Variant soil also is a limitation. Trees and shrubs can be established, but optimum growth is unlikely.

The Emigrant soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 6R; the Beckton Variant soil is in capability unit IVs-3, Claypan range site, and windbreak suitability group 9.

EcD—Emigrant-Conata complex, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Emigrant soil is on side slopes. The shallow Conata soil is on ridges. Areas are irregular in shape and 10 to 300 acres in size. They are 45 to 55 percent Emigrant soil and 25 to 35 percent Conata soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Emigrant soil is dark grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, grayish brown, and light brownish gray, friable and firm clay loam and clay. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 30 inches. In places the subsoil contains more sand. In some areas the depth to shale is more than 40 inches. In other areas the subsoil is underlain by limestone.

Typically, the surface layer of the Conata soil is brown clay about 6 inches thick. It is calcareous in the lower part. The subsoil is multicolored, firm and very firm, calcareous clay about 12 inches thick. It has accumulations of carbonates throughout. Multicolored, calcareous shale is at a depth of about 18 inches. In

places the depth to shale is less than 10 inches. In some areas scattered limestone fragments are on the surface.

Included with these soils in mapping are small areas of Beckton Variant, Larvie, Metre, Pierre, and Promise soils and Rock outcrop. These inclusions make up less than 20 percent of any one mapped area. Beckton Variant soils have a sodium affected subsoil. They are in slight depressions on the less sloping parts of the landscape. The moderately deep Larvie, Metre, and Pierre soils and the deep Promise soils contain more clay throughout than the Emigrant soil. They are in positions on the landscape similar to those of the Emigrant soil. The Rock outcrop consists of limestone and shale in rimrock areas.

The content of organic matter is moderate in the Emigrant soil and low in the Conata soil. Fertility is medium in the Emigrant soil and low in the Conata soil. Available water capacity is low in both soils. Permeability is moderately slow in the Emigrant soil and very slow in the Conata soil. Runoff is rapid on both soils. The shrink-swell potential is high in the Emigrant soil and very high in the Conata soil.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying. Sites for stock water impoundments are available in some of the draws. Seepage could be a problem.

These soils generally are unsuited to cultivated crops. The Emigrant soil is suited to windbreaks and environmental plantings and to tame pasture and hay but the slope is a limitation. Planting trees and shrubs on the contour helps to control erosion. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are suitable pasture plants. The Conata soil generally is unsuited to windbreaks and environmental plantings and to tame pasture and hay because of the slope and the shallow depth to bedrock.

The Emigrant soil is in capability unit VIe-1, Silty range site, and windbreak suitability group 6R; the Conata soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10.

ErB—Emigrant-Razor complex, 1 to 6 percent slopes. These moderately deep, well drained, nearly level and gently sloping soils are on uplands. The Emigrant soil is on the lower side slopes and in concave areas. The Razor soil is on low ridges and convex side slopes. Areas are irregular in shape and 10 to several hundred acres in size. They are 45 to 55 percent Emigrant soil and 25 to 45 percent Razor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Emigrant soil is dark grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, grayish brown, and light brownish gray, friable and firm clay loam and clay. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 30 inches. In places the depth to shale is more than 40 inches. In some areas the subsoil contains more silt and less sand.

Typically, the surface layer of the Razor soil is grayish brown silty clay loam about 3 inches thick. The subsoil is grayish brown, light yellowish brown, and light gray, friable and firm silty clay loam about 30 inches thick. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is dark grayish brown.

Included with these soils in mapping are small areas of Beckton Variant, Hisle, Midway, Pierre, and Promise soils. These included soils make up less than 20 percent of any one mapped area. Beckton Variant and Hisle soils have a sodium affected subsoil. They are in swales and small depressions. Midway soils are 10 to 20 inches deep over shale. They are on ridges. Pierre and Promise soils contain more clay in the subsoil than the Emigrant and Razor soils. They are on the lower side slopes.

The content of organic matter is moderate in the Emigrant soil and low in the Razor soil. Fertility is medium in the Emigrant soil and low in the Razor soil. Tilth is good in the Emigrant soil and fair in the Razor soil. Available water capacity is low in both soils. Permeability is moderately slow in the Emigrant soil and slow in the Razor soil. Runoff is medium on both soils. The shrink-swell potential is high.

About half of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are suitable pasture plants. Winter wheat and oats are the main cultivated crops. Measures that conserve moisture, control erosion, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake. Terraces and grassed waterways help to control erosion.

These soils are suited to windbreaks and environmental plantings, but they are droughty. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The Emigrant soil is in capability unit IIIe-1, Silty range site, and windbreak suitability group 6R; the Razor soil is

in capability unit IVe-3, Clayey Range site, and windbreak suitability group 4C.

ErC—Emigrant-Razor complex, 6 to 9 percent slopes. These moderately deep, well drained, moderately sloping soils are on uplands. The Emigrant soil is on convex side slopes. The Razor soil is on ridges. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 50 percent Emigrant soil and 30 to 40 percent Razor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Emigrant soil is dark grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, grayish brown, and light brownish gray, friable and firm clay loam and clay. It is calcareous in the lower part. Light gray shale is at a depth of about 30 inches. In places the subsoil contains less clay and more silt. In some areas the depth to shale is more than 40 inches.

Typically, the surface layer of the Razor soil is grayish brown silty clay loam about 3 inches thick. The subsoil is grayish brown, light yellowish brown, and light gray, friable and firm silty clay loam about 30 inches thick. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 33 inches. In places the subsoil contains more sand.

Included with these soils in mapping are small areas of Arvada, Beckton Variant, Hisle, Midway, Nihill, Pierre, and Promise soils. These included soils make up less than 20 percent of any one mapped area. Arvada, Beckton Variant, and Hisle soils have a sodium affected subsoil. They are on low side slopes. Midway and Nihill soils are on ridges. Midway soils are 10 to 20 inches deep over shale. Nihill soils are gravelly throughout. Pierre and Promise soils contain more clay throughout than the Razor soil. They are on the lower side slopes adjacent to drainageways.

The content of organic matter is moderate in the Emigrant soil and low in the Razor soil. Fertility is medium in the Emigrant soil and low in the Razor soil. Tilth is good in the Emigrant soil and fair in the Razor soil. Available water capacity is low in both soils. Permeability is moderately slow in the Emigrant soil and slow in the Razor soil. Runoff is medium on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, and intermediate wheatgrass are suitable pasture plants. Measures that control erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Terraces and grassed waterways help to control erosion. Chiseling or subsoiling improves tilth and increases the rate of water intake.

These soils are suited to windbreaks and environmental plantings, but droughtiness is a limitation. Trees and shrubs can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The Emigrant soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 6R; the Razor soil is in capability unit IVe-14, Clayey range site, and windbreak suitability group 4C.

ErD—Emigrant-Razor complex, 9 to 15 percent slopes. These moderately deep, well drained, strongly sloping soils are on uplands. The Emigrant soil is on concave side slopes. The Razor soil is on the convex upper side slopes and on ridges. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 50 percent Emigrant soil and 30 to 40 percent Razor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Emigrant soil is dark grayish brown loam about 3 inches thick. The subsoil is about 27 inches thick. It is dark grayish brown, grayish brown, and light brownish gray, friable and firm clay loam and clay. It is calcareous in the lower part. Light gray shale is at a depth of about 30 inches. In places the depth to shale is more than 40 inches. In some areas the subsoil contains less clay and more silt.

Typically, the surface layer of the Razor soil is grayish brown silty clay loam about 3 inches thick. The subsoil is grayish brown, light yellowish brown, and light gray, friable and firm silty clay loam about 30 inches thick. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 33 inches. In places the subsoil contains more sand.

Included with these soils in mapping are small areas of Arvada, Beckton Variant, Hisle, Midway, and Nihill soils. These included soils make up less than 20 percent of any one mapped area. Arvada, Beckton Variant, and Hisle soils have a sodium affected subsoil. They are on low side slopes. Midway and Nihill soils are on ridges. Midway soils are 10 to 20 inches deep over shale. Nihill soils are gravelly throughout.

The content of organic matter is moderate in the Emigrant soil and low in the Razor soil. Fertility is medium in the Emigrant soil and low in the Razor soil. Tilth is good in the Emigrant soil and fair in the Razor soil. Available water capacity is low in both soils. Permeability is moderately slow in the Emigrant soil and slow in the Razor soil. Runoff is medium on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils generally are too steep for cultivated crops. They are suited to tame pasture and hay and to windbreaks and environmental plantings, but the slope is a limitation. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are suitable pasture plants. Planting trees and shrubs on the contour helps to control erosion.

The Emigrant soil is in capability unit VIe-1, Silty range site, and windbreak suitability group 6R; the Razor soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C.

Fv—Fluvaquents, flooded. These deep, somewhat poorly drained, nearly level soils are in old stream channels on flood plains along the White River. They are frequently flooded for long periods. Areas are long and narrow and are 10 to 90 acres in size.

Typically, the surface layer is light brownish gray, calcareous silty clay, but it ranges from clay to silty clay loam. The underlying material is pale brown and light gray, stratified, calcareous fine sand to silty clay. In some areas sand and gravelly sand are at a depth of 40 inches.

Included with these soils in mapping are small areas of the well drained Bankard Variant, Craft, Haverson, and Lohmiller soils. These soils make up less than 15 percent of any one mapped area. They are higher on the flood plains than the Fluvaquents.

The content of organic matter is moderate and fertility medium in the Fluvaquents. A seasonal high water table is at or near the surface most of the year. As much as 3 feet of water ponds on the surface during some wet periods. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing or hay. Compaction is a problem. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings. Wetness is the main limitation. The soils are suited to tame pasture and hay, but the excess moisture limits the choice of pasture plants. Garrison creeping foxtail, reed canarygrass, and western wheatgrass grow well.

The capability unit is VIw-2; Subirrigated range site; windbreak suitability group 10.

Ha—Haverson loam. This deep, well drained, nearly level soil is on flood plains along the White River. It is subject to rare flooding of brief duration. Areas are irregular in shape and 10 to 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is light brownish gray, calcareous loam about 7 inches thick. The upper 28 inches of the underlying material is light gray and light brownish gray, calcareous, stratified loam, silt loam, and clay loam. The lower part to a depth of 60 inches is light gray, calcareous fine sand. In places gravelly sand is below a depth of 40 inches. In some areas the surface layer is very fine sandy loam.

Included with this soil in mapping are small areas of Bankard Variant, Craft, Hilmoe, Lohmiller, and Wendte soils. These soils make up less than 15 percent of any one mapped area. Bankard Variant and Craft soils contain less clay and Hilmoe, Lohmiller, and Wendte soils more clay between depths of 10 and 40 inches than the Haverson soil. Bankard Variant soils are adjacent to the river. Craft soils are on rises. Hilmoe, Lohmiller, and Wendte soils are adjacent to the uplands.

The content of organic matter and fertility are low in the Haverson soil. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is slow.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, and intermediate wheatgrass are the best suited pasture plants. Winter wheat, sorghum, and oats are the main crops. Measures that improve fertility and conserve moisture are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. The soil is suited to irrigation.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. The trees and shrubs that require an abundant supply of moisture grow especially well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

Hc—Haverson-Craft complex. These deep, well drained, nearly level soils are on flood plains along the White River. They are subject to rare flooding of brief duration. The Haverson soil is on the low parts of the flood plains. The Craft soil is on slight rises. Areas are irregular in shape and 10 to 200 acres in size. They are 30 to 55 percent Haverson soil and 25 to 50 percent Craft soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Haverson soil is light brownish gray, calcareous loam about 7 inches thick. The upper 28 inches of the underlying material is light gray and light brownish gray, calcareous, stratified loam, silt loam, and clay loam. The lower part to a depth of 60

inches is light gray, calcareous fine sand. In places gravelly sand is below a depth of 40 inches.

Typically, the surface layer of the Craft soil is light gray, calcareous very fine sandy loam about 6 inches thick. The upper 36 inches of the underlying material is light gray, calcareous, stratified very fine sandy loam, loam, and loamy very fine sand. The lower part to a depth of 60 inches is light gray, calcareous, stratified fine sand and very fine sand. In places gravelly sand is below a depth of 40 inches.

Included with these soils in mapping are small areas of Bankard Variant, Hilmoe, Lohmiller, and Wendte soils. These included soils make up less than 20 percent of any one mapped area. Bankard Variant soils contain more fine sand between depths of 10 and 40 inches than the Haverson and Craft soils. They are adjacent to the river in most areas but in some areas are in positions on the landscape similar to those of the Craft soil. Hilmoe, Lohmiller, and Wendte soils contain more clay between depths of 10 and 40 inches than the Haverson and Craft soils. They are adjacent to the uplands.

The content of organic matter and fertility are low in the Haverson and Craft soils. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is slow.

About half of the acreage supports native grasses and is used for grazing or hay. Generally, no major hazards or limitations affect the use of these soils for range; however, overgrazed areas of the Craft soil are subject to wind erosion.

These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, intermediate wheatgrass, and pubescent wheatgrass are suitable pasture plants. Winter wheat, sudangrass, and alfalfa are the main crops. Measures that conserve moisture and improve fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. The soils are suited to irrigation.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

Ho—Hilmoe silty clay. This deep, moderately well drained, nearly level soil is on flood plains. It is subject to rare flooding of brief duration. Areas are irregular in shape and 10 to 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is gray silty clay about 5 inches thick. The next layer is gray, light brownish gray, and grayish brown, firm, calcareous clay about 20 inches thick. It is stratified in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous, stratified fine sandy loam, fine sand, and silt loam. In places the underlying material contains more clay. In some areas the surface layer is light gray or pale brown.

Included with this soil in mapping are small areas of Bankard Variant, Craft, and Haverson soils. These soils make up less than 15 percent of any one mapped area. Bankard Variant, Craft, and Haverson soils contain less clay than the Hilmoe soil. Also, they are nearer to the river.

The content of organic matter is moderate and fertility medium in the Hilmoe soil. Tilth is poor. Available water capacity is moderate or high. Permeability is slow in the upper part of the soil and moderate in the underlying material. Runoff is slow. The shrink-swell potential is high in the upper part of the soil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa, intermediate wheatgrass, green needlegrass, and western wheatgrass. Winter wheat, grain sorghum, and oats are the main crops. The soil becomes compacted if farmed when wet and is difficult to till when dry. Measures that conserve moisture and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey Overflow range site; windbreak suitability group 4C.

HpC—Hisle silt loam, 0 to 9 percent slopes. This moderately deep, well drained, nearly level to moderately sloping, sodium affected soil is on uplands. Areas are irregular in shape and 10 to 400 acres in size.

Typically, the surface layer is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the surface layer is thicker. In some areas the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Kyle, Larvie, Metre, Pierre, and Razor soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Kyle, Larvie, Metre, Pierre, and Razor soils do not have a sodium affected subsoil. They are higher on the landscape than the Hisle

soil. Slickspots are bare areas of highly dispersed clay in slight depressions.

The content of organic matter and fertility are low in the Hisle soil. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil generally is unsuited to cultivated crops, windbreaks and environmental plantings, and tame pasture and hay. The dense, compacted subsoil and high content of sodium restrict root penetration.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

HrC—Hisle-Rock outcrop complex, 0 to 9 percent slopes. This map unit occurs as areas of a moderately deep, nearly level to moderately sloping, sodium affected Hisle soil intermingled with areas of Rock outcrop. The unit is on uplands. The well drained Hisle soil is in vegetated areas on the slightly higher rises and flats. The Rock outcrop is bare or very sparsely vegetated. Areas are irregular in shape and are 10 to 100 acres in size. They are 40 to 55 percent Hisle soil and 25 to 40 percent Rock outcrop. The Hisle soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous, clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the surface layer is fine sandy loam. In some areas the depth to shale is less than 20 inches, and in other areas it is more than 40 inches.

The Rock outcrop consists of exposures of multicolored shale that support little or no vegetation. Many areas have a thin layer of gravel at the surface. Some are nearly level, and others are convex. In places visible salts are at or near the surface.

Included with the Hisle soil and Rock outcrop in mapping are small areas of Conata, Larvie, Metre, Pierre, and Samsil soils. These included soils make up less than 20 percent of any one mapped area. They do not have a sodium affected subsoil. They are on the high parts of the landscape.

The content of organic matter and fertility are low in the Hisle soil. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. Available water capacity is low. Permeability is very slow. Runoff is medium on the Hisle soil and rapid on the Rock outcrop. The shrink-swell potential is very high in the Hisle soil.

Most of the acreage supports native grasses and is used for grazing; however, the Rock outcrop does not support grazable vegetation. Compaction is a problem on the Hisle soil. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Rock outcrop and the dense, compacted subsoil and high content of sodium salts in the Hisle soil are the main limitations.

The Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Rock outcrop is in capability unit VIIIs-2 and is not assigned to a range site or a windbreak suitability group.

HsC—Hisle-Slickspots complex, 0 to 9 percent slopes. This map unit occurs as areas of a moderately deep, nearly level to moderately sloping, sodium affected Hisle soil intermingled with Slickspots. The unit is on uplands. The well drained Hisle soil is in vegetated areas on slight rises and on flats. Slickspots generally are in small depressions. Areas are irregular in shape and are 10 to 100 acres in size. They are 45 to 60 percent Hisle soil and 20 to 35 percent Slickspots. The Hisle soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the surface layer is fine sandy loam. In some areas the depth to shale is less than 20 inches, and in other areas it is more than 40 inches.

The surface of the Slickspots is dense, massive clay. Visible salts are at or near the surface. The underlying material to a depth of 35 inches is very firm, calcareous clay. Shale is at a depth of about 35 inches.

Included with the Hisle soil and Slickspots in mapping are small areas of Conata, Larvie, Metre, Pierre, and Samsil soils. These included soils make up less than 20 percent of any one mapped area. They do not have a sodium affected subsoil. They are on the high parts of the landscape.

The content of organic matter and fertility are low in the Hisle soil. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. Available water capacity is low. Permeability is very slow. Runoff is medium on the Hisle soil and slow on the Slickspots. The shrink-swell potential is very high in the Hisle soil.

Figure 6.—An area of Hisle-Slickspots complex, 0 to 9 percent slopes. The Slickspots do not support grazable vegetation. An area of Interior-Cedarpass-Badland complex, 0 to 6 percent slopes, is in the background.

Most of the acreage supports native grasses and is used for grazing; however, Slickspots do not support grazable vegetation (fig. 6). Compaction is a problem on the Hisle soil. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Slickspots and the dense, compacted subsoil and high content of sodium salts in the Hisle soil are the main limitations.

The Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or a windbreak suitability group.

Hu—Hurley silt loam. This deep, moderately well drained, nearly level, sodium affected soil is along drainageways in the uplands. Areas are long and narrow and are 10 to several hundred acres in size.

Typically, the surface layer is light gray silt loam about 2 inches thick. The subsoil is dark gray, gray, and light brownish gray, firm and very firm clay about 31 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, light gray, and light brownish gray, calcareous clay. It has nests of visible salts throughout.

Included with this soil in mapping are small areas of Nunn, Pierre, Promise, and Wendte soils. These soils make up less than 15 percent of any one mapped area. They do not have a sodium affected subsoil. Nunn, Pierre, and Promise soils are slightly higher on the landscape than the Hurley soil. Lohmiller and Wendte soils are on flood plains.

The content of organic matter and fertility are low in the Hurley soil. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. Available water capacity is low or moderate. Permeability is very slow.

The runoff is slow. The runoff from adjacent slopes can cause some flooding after periods of rainfall early in the year. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The sodium affected subsoil is a limitation.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

In—Interior loam. This deep, well drained, nearly level, sodium-rich soil is on flood plains and fans at the base of Badland outcrops (fig. 7). It is frequently flooded for brief periods. Areas are irregular in shape and 10 to 200 acres in size.

Typically, the surface layer is light gray, calcareous loam about 4 inches thick. The underlying material to a depth of 60 inches is light gray and white, calcareous, stratified loam, silt loam, and silty clay loam.

Included with this soil in mapping are small areas of Cedarpass, Denby, Norrest, and Wanblee soils. These soils make up less than 15 percent of any one mapped area. They are not so stratified as the Interior soil. Also, they are higher on the landscape.

The content of organic matter is very low and fertility low in the Interior soil. Tilth is good. Available water capacity is moderate or high. The high content of sodium restricts plant growth. Permeability is moderately slow. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, overgrazed areas are subject to wind erosion.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The high content of sodium is a limitation.

The capability unit is VIs-7; Badland Overflow range site; windbreak suitability group 10.

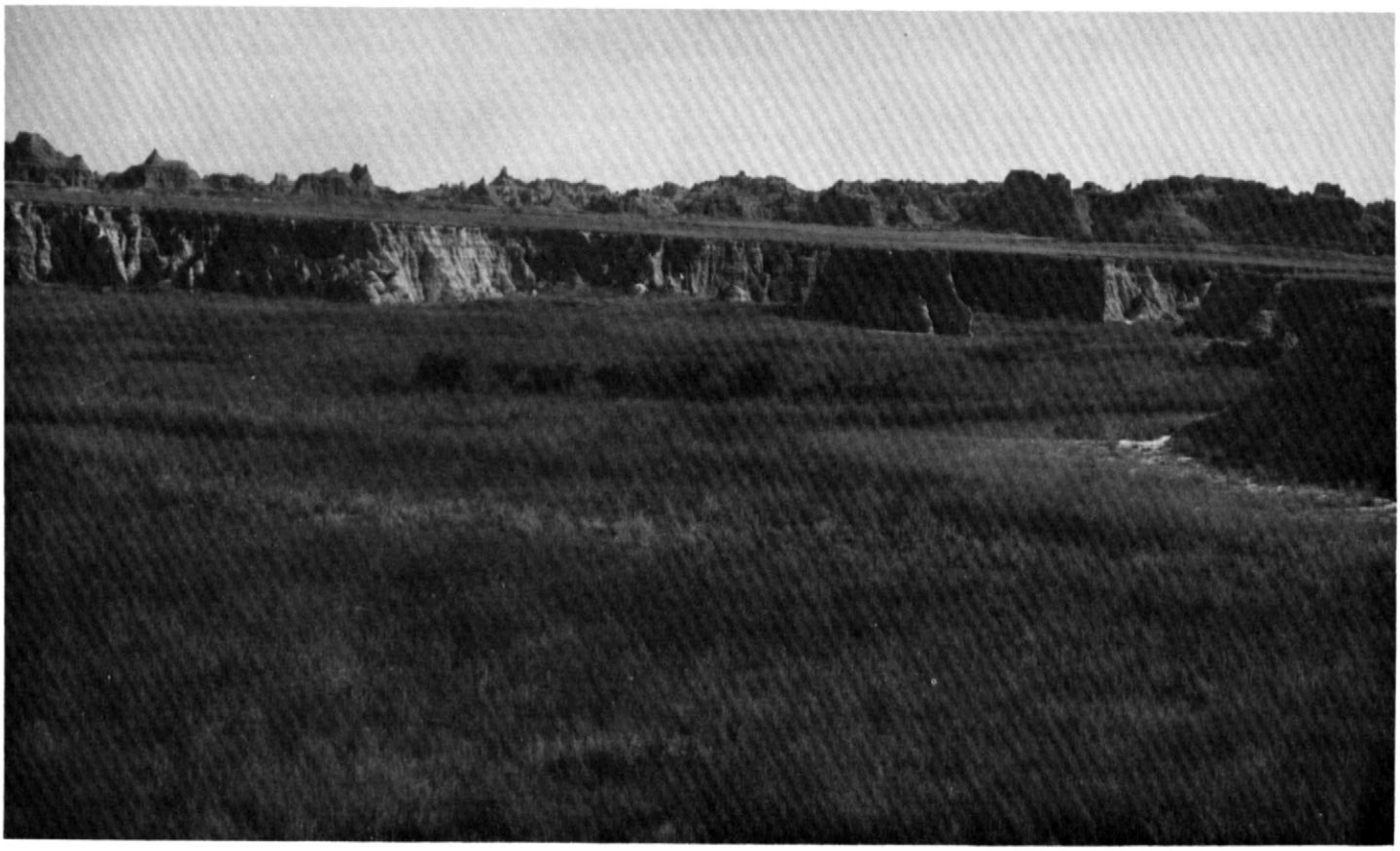

Figure 7.—An area of Interior loam. Cedarpass silt loam, 0 to 3 percent slopes, is on the mesa in the background.

Figure 8.—An area of Interior loam, channeled.

Io—Interior loam, channeled. This deep, well drained, sodium-rich soil is on narrow flood plains that are dissected into many small tracts by narrow channels (fig. 8). It is frequently flooded for brief periods. Areas are long and narrow and are 10 to several hundred acres in size.

Typically, the surface layer is light gray, calcareous loam about 4 inches thick. The underlying material to a depth of 60 inches is light gray and white, calcareous, stratified loam, silt loam, and silty clay loam.

Included with this soil in mapping are small areas of Absted, Arvada, Cedarpass, Denby, and Kyle soils. These soils make up less than 15 percent of any one mapped area. Absted and Arvada soils have a sodium affected subsoil. They are in shallow depressions. Cedarpass and Denby soils are not so stratified as the Interior soil. They are on the high parts of the landscape. Kyle soils contain more clay throughout than the Interior soil. They are on uplands.

The content of organic matter is very low and fertility low in the Interior soil. Tilth is good. The high content of

sodium restricts plant growth. Available water capacity is moderate or high. Permeability is moderately slow. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, overgrazed areas are subject to wind erosion. Pools of water in some areas of the channels are temporary watering sites for livestock and wildlife.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The high content of sodium throughout the soil and the deep, meandering stream channels are limitations.

The capability unit is VIw-1; Badland Overflow range site; windbreak suitability group 10.

IsB—Interior-Cedarpass-Badland complex, 0 to 6 percent slopes. This map unit occurs as areas of deep, well drained, nearly level and gently sloping, sodium-rich soils intermingled with Badland (fig. 9). The unit is on uplands dissected by drainageways. The Interior soil is along the drainageways. It is frequently flooded for brief periods. The Cedarpass soil is on mesas or plateaus that are 3 to 20 feet above the Interior soil. Badland occurs in a random pattern throughout the mapped areas. Areas are irregular in shape and 10 to 2,500 acres in size. They are 30 to 35 percent Interior soil, 25 to 30 percent Cedarpass soil, and 20 to 25 percent Badland. The two soils and the Badland occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Interior soil is light gray, calcareous loam about 4 inches thick. The underlying material to a depth of 60 inches is light gray and white, calcareous, stratified loam, silt loam, and silty clay loam.

Typically, the surface layer of the Cedarpass soil is brown silt loam about 3 inches thick. The subsoil is light brownish gray, pale brown, and very pale brown, friable,

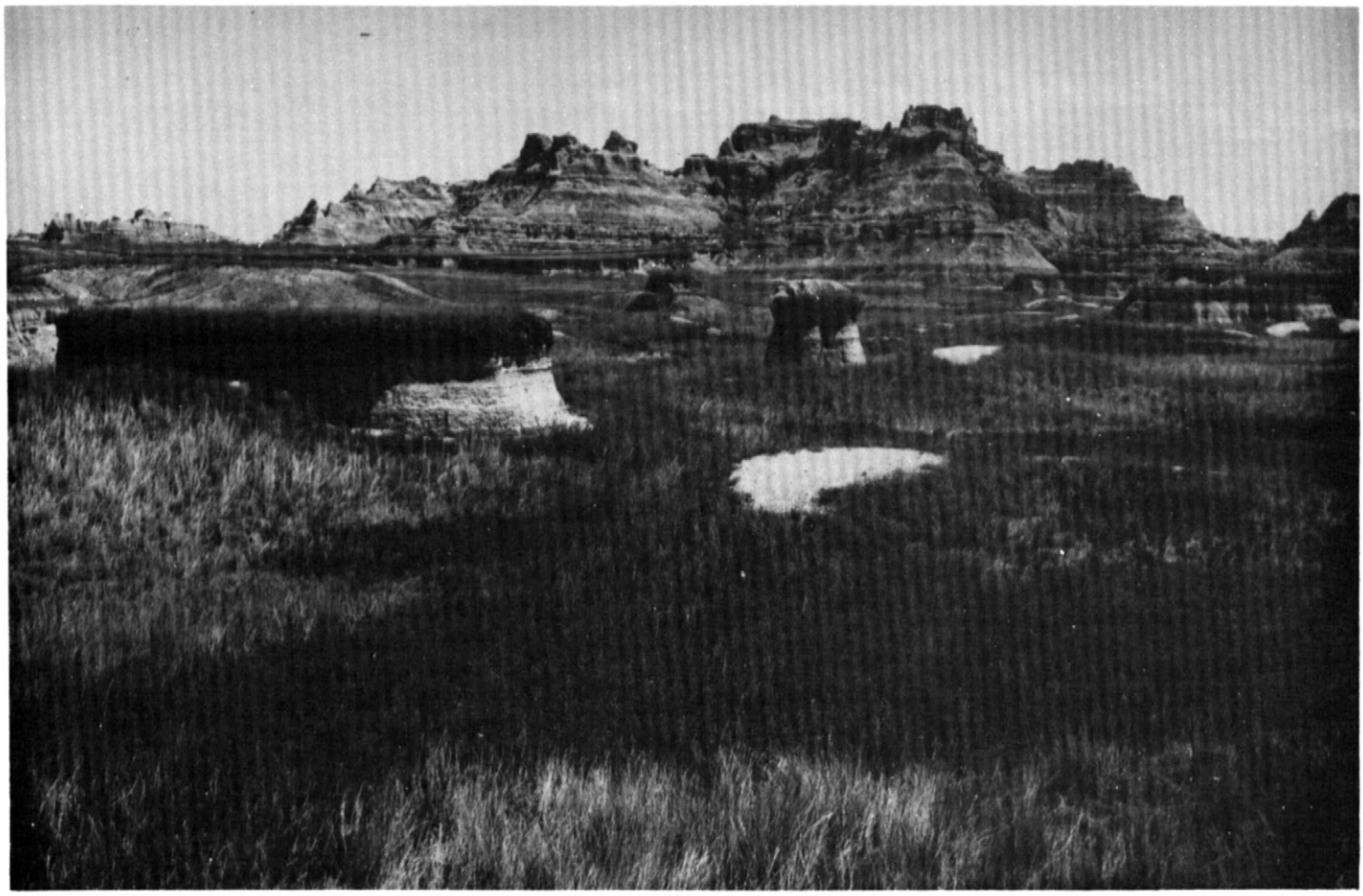

Figure 9.—An area of Interior-Cedarpass-Badland complex, 0 to 6 percent slopes.

calcareous silt loam about 14 inches thick. The underlying material to a depth of 60 inches is very pale brown and light brownish gray, calcareous, stratified silt loam, very fine sandy loam, loam, and silty clay loam. In some places the surface layer and the upper part of the subsoil are dark gray or dark grayish brown. In other places siltstone and shale are at a depth of 20 to 40 inches.

Badland occurs as exposures of bedrock of the Brule, Chadron, and Pierre Formations on mounds, pinnacles, and escarpments. It supports little or no vegetation.

Included in this unit in mapping are small areas of Denby, Norrest, Orella, Wanblee, and Whitewater soils. These soils make up less than 20 percent of any one mapped area. Denby soils contain more clay throughout than the Interior and Cedarpass soils. They are in positions on the landscape similar to those of the Cedarpass soil. Norrest, Orella, Wanblee, and Whitewater soils are less than 40 inches deep over bedrock. They are higher on the landscape than the Interior and Cedarpass soils.

The content of organic matter is very low in the Interior soil and moderate in the Cedarpass soil. Fertility is low in the Interior soil and medium in the Cedarpass soil. Tilth is good in both soils. The high content of sodium adversely affects plant growth. Available water capacity is moderate or high. Permeability is moderately slow in the Interior soil and moderate in the Cedarpass soil. Runoff is slow on both of the soils and rapid in areas of Badland. The shrink-swell potential is low in the Interior soil and moderate in the Cedarpass soil.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this map unit for range; however, some areas of the Cedarpass soil are inaccessible to livestock because they are on small mesas that have perpendicular sides. The Badland does not support grazable vegetation.

This map unit generally is unsuited to cultivated crops. Because of the Badland, areas of the Interior and Cedarpass soils are divided into many small tracts that are not accessible to modern farming equipment. The high content of sodium in the Interior soil also is a limitation.

Windbreaks and environmental plantings can be planted on the Cedarpass soil, but inaccessibility and the high content of sodium in the lower part of the subsoil are limitations. Optimum growth and vigor are unlikely. The Interior soil and Badland are unsuited to windbreaks and environmental plantings.

The capability unit is VIIs-6. The Interior soil is in Badland Overflow range site and windbreak suitability group 10; the Cedarpass soil is in Silty range site and windbreak suitability group 8; Badland is not assigned to a range site or a windbreak suitability group.

Iv—Interior-Denby-Cedarpass complex, 0 to 3 percent slopes. These deep, well drained, nearly level, sodium-rich soils are on uplands that are dissected by many drainageways. The Interior soil is along the drainageways. It is frequently flooded for brief periods. The Denby and Cedarpass soils are on mesas and small plateaus that are several feet higher than the Interior soil. Areas are irregular in shape and 10 to several hundred acres in size. They are 25 to 35 percent Interior soil, 20 to 30 percent Denby soil, and 20 to 25 percent Cedarpass soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Interior soil is light gray, calcareous loam about 4 inches thick. The underlying material to a depth of 60 inches is light gray and white, calcareous, stratified loam, silt loam, and silty clay loam.

Typically, the surface layer of the Denby soil is light brownish gray, calcareous silty clay about 5 inches thick. The subsoil is about 22 inches thick. It is light brownish gray, firm, calcareous silty clay in the upper part and very pale brown, friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, gray, and light gray, calcareous silty clay, silty clay loam, and silt loam. In places bedrock is at a depth of 20 to 40 inches.

Typically, the surface layer of the Cedarpass soil is brown silt loam about 3 inches thick. The subsoil is about 14 inches thick. It is light brownish gray, pale brown, and very pale brown, friable, calcareous silt loam. The underlying material to a depth of 60 inches is very pale brown and light brownish gray, calcareous, stratified silt loam, very fine sandy loam, loam, and silty clay loam. In places the surface layer and the upper part of the subsoil are dark gray or dark grayish brown. In some areas bedrock is at a depth of 20 to 40 inches.

Included with these soils in mapping are small areas of Norrest, Orella, Wanblee, and Whitewater soils and areas of Badland. These inclusions make up less than 20 percent of any one mapped area. They are less than 40 inches deep over bedrock. They generally are higher on the landscape than the Denby, Cedarpass, and Interior soils. Badland occurs as escarpments, low mounds, or small spires and peaks that do not support vegetation.

The content of organic matter is very low in the Interior soil, low in the Denby soil, and moderate in the Cedarpass soil. Fertility is low in the Denby and Interior soils and medium in the Cedarpass soil. Tilth is good in the Cedarpass and Interior soils and poor in the Denby soil. The high content of sodium in the Interior soil restricts plant growth. Available water capacity is moderate or high in the Cedarpass and Interior soils and moderate in the Denby soil. Permeability is slow in the Denby soil, moderate in the Cedarpass soil, and moderately slow in the Interior soil. Runoff is slow on all

three soils. The shrink-swell potential is high in the subsoil of the Denby soil and moderate in the underlying material. It is moderate in the subsoil of the Cedarpass soil.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards of limitations affect the use of these soils for range; however, compaction is a problem on the Denby soil and wind erosion is a hazard in overgrazed areas of the Interior soil.

These soils generally are unsuited to cultivated crops because the numerous escarpments limit the accessibility to farm machinery. In areas where seedbed preparation is possible, the Denby and Cedarpass soils are suited to tame pasture and hay. Alfalfa, green needlegrass, and intermediate wheatgrass are suitable pasture plants.

The Denby and Cedarpass soils are suited to windbreaks and environmental plantings. The clayey subsoil in the Denby soil, however, can restrict root penetration. The high content of sodium in the subsoil of the Cedarpass soil also is a limitation. No trees or shrubs grow well on the Interior soil, mainly because of the escarpments and drainageways and the high content of sodium. Hand planting is needed in many areas because machine planting is not possible.

The capability unit is VIs-7. The Interior soil is in Badland Overflow range site and windbreak suitability group 10; the Denby soil is in Clayey range site and windbreak suitability group 4C; the Cedarpass soil is in Silty range site and windbreak suitability group 8.

Ko—Kolls clay. This deep, poorly drained, level soil is in depressions on uplands. It is ponded in the spring and after periods of high rainfall. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend throughout the subsoil. Areas are oval and 5 to 100 acres in size.

Typically, the surface layer is dark gray, calcareous clay about 3 inches thick. The subsoil is dark gray, gray, and grayish brown, very firm and firm, calcareous clay about 39 inches thick. It has gypsum crystals in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. In places shale, sandstone, or sand is below a depth of 40 inches. In some areas the subsoil and underlying material contain less clay.

Included with this soil in mapping are small areas of Arvada, Beckton, Hurley, Nunn, and Promise soils. These soils make up less than 15 percent of any one mapped area. They are well drained or moderately well drained and are higher on the landscape than the Kolls soil. Arvada, Beckton, and Hurley soils have a sodium affected subsoil.

The content of organic matter is moderate and fertility medium in the Kolls soil. Tilth is poor. Available water capacity is low or moderate. A seasonal high water table is within a depth of 1.5 feet. As much as 0.5 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction and ponding are problems. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops and to windbreaks and environmental plantings. It has a dense, compacted subsoil and is subject to long periods of ponding. It is suited to tame pasture and hay, but the choice of pasture plants is limited because natural drainage is restricted and artificial drainage is not feasible. Western wheatgrass is an example of a suitable pasture plant.

The capability unit is Vw-1; Closed Depression range site; windbreak suitability group 10.

KyA—Kyle clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on foot slopes and fans in the uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 300 acres in size. Slopes are long and are smooth or slightly convex.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 20 inches thick. The underlying material to a depth of 60 inches is olive, calcareous clay. It has accumulations of gypsum crystals throughout. In some places shale is at a depth of 20 to 40 inches. In other places gypsum crystals are at or near the surface. In some areas the surface layer is dark gray or dark grayish brown.

Included with this soil in mapping are small areas of Arvada and Hisle soils. These soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil. They are slightly lower on the landscape than the Kyle soil.

The content of organic matter and fertility are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing and hay. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, smooth bromegrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet and is difficult to till when dry. Winter wheat, oats, and grain sorghum are the main crops. Measures that conserve moisture and improve tilth and fertility are the main management needs. Examples are leaving crop

residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

KyB—Kyle clay, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on foot slopes and fans in the uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are long and are smooth or slightly concave.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 20 inches thick. The underlying material to a depth of 60 inches is olive, calcareous clay. It has accumulations of gypsum crystals throughout. In places the gypsum crystals are at or near the surface. In some areas shale is at a depth of 20 to 40 inches. In other areas the surface layer is dark gray or dark grayish brown.

Included with this soil in mapping are small areas of Arvada and Hisle soils. These soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil. They are slightly lower on the landscape than the Kyle soil.

The content of organic matter and fertility are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet and is difficult to till when dry. Winter wheat, oats, and grain sorghum are the main crops. Measures that conserve moisture, control erosion, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways help to control erosion. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

KyC—Kyle clay, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on foot slopes and fans in the uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are long and are smooth or slightly concave.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown, very firm, calcareous clay about 20 inches thick. The underlying material to a depth of 60 inches is olive, calcareous clay. It has accumulations of gypsum crystals throughout. In places the gypsum crystals are at or near the surface. In some areas shale is at a depth of 20 to 40 inches. In other areas the surface layer is dark gray or dark grayish brown.

Included with this soil in mapping are small areas of Arvada and Hisle soils. These soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil. They are slightly lower on the landscape than the Kyle soil.

The content of organic matter and fertility are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples of suitable pasture plants. The soil becomes compacted if farmed when wet and is difficult to till when dry. Winter wheat and oats are the main crops. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, grassed waterways, and terraces help to control erosion. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings, but the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-14; Clayey range site; windbreak suitability group 4C.

LcD—Larvie-Conata clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Larvie soil is on side slopes. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The shallow Conata soil is on ridges. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 60 percent Larvie soil and 20 to 40 percent Conata soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Larvie soil is dark brown, calcareous clay about 5 inches thick. The subsoil is weak red, very firm, calcareous clay about 21 inches thick. It has gypsum crystals in the lower part. Weak red, calcareous shale is at a depth of about 26 inches. It has gypsum crystals in the upper part. In some places the surface layer is dark gray or dark grayish brown. In other places shale is at a depth of more than 40 inches. In some areas the subsoil and the shale are olive or grayish brown.

Typically, the surface layer of the Conata soil is brown clay about 6 inches thick. It is calcareous in the lower part. The subsoil is multicolored, firm and very firm, calcareous clay about 12 inches thick. It has accumulations of carbonates throughout. Multicolored, calcareous shale is at a depth of about 18 inches. In places the subsoil contains visible salts.

Included with these soils in mapping are small areas of Beckton Variant and Hisle soils. These included soils make up less than 20 percent of any one mapped area. They have a sodium affected subsoil. Beckton Variant soils are on the less sloping tops of high ridges. Hisle soils are on foot slopes.

The content of organic matter and fertility are low in the Larvie and Conata soils. Tilth is poor. Available water capacity is low. Permeability is very slow. Runoff is high. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws. Seepage could be a problem.

These soils generally are unsuited to cultivated crops. The slope of both soils and the shallow depth to shale in the Conata soil are limitations. The Larvie soil is suited to tame pasture and hay and to windbreaks and environmental plantings, but the Conata soil is unsuited. Intermediate wheatgrass and western wheatgrass are examples of suitable pasture plants. Windbreaks and environmental plantings can be established on the Larvie soil, but the clayey subsoil can restrict the penetration of plant roots. Optimum growth is unlikely. Planting on the contour helps to control erosion.

The Larvie soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C; the Conata soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10.

LhC—Larvie-Hisle complex, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are on uplands. The Larvie soil is on the convex slopes. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The sodium affected Hisle soil is on side slopes and in shallow depressions. Areas are irregular in shape and 10 to several hundred acres in size. They are 40 to 60 percent Larvie soil and 25 to 40 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Larvie soil is dark brown, calcareous clay about 5 inches thick. The subsoil is weak red, very firm, calcareous clay about 21 inches thick. It has gypsum crystals in the lower part. Weak red, calcareous shale is at a depth of about 26 inches. It has gypsum crystals in the upper part. In some places the depth to shale is more than 40 inches. In other places the surface layer is dark gray or dark grayish brown. In some areas the subsoil and the shale are olive or grayish brown.

Typically, the surface layer of the Hisle soil is light brownish gray silt loam about 1 inch thick. The subsoil is brown, weak red, and pale red, firm clay about 30 inches thick. In the lower part it has visible salts and is calcareous. Pale red, calcareous shale is at a depth of about 31 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is thicker.

Included with these soils in mapping are small areas of Denby, Orella, and Whitewater soils. These included soils make up less than 20 percent of any one mapped area. Denby soils are more than 40 inches deep over shale. They are on the low parts of the landscape. Orella soils are 10 to 20 inches deep over shale. They are higher on the landscape than the Larvie and Hisle soils. Whitewater soils formed in sodium-rich shale residuum. They are in positions on the landscape similar to those of the Larvie soil.

The content of organic matter and fertility are low in the Larvie and Hisle soils. Tilth is poor. The sodium affected subsoil in the Hisle soil restricts root penetration. Available water capacity is low in both soils. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most areas support native grasses and are used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass and

western wheatgrass can be grown on the Larvie soil, but very little production can be expected on the Hisle soil. The dense, sodium affected subsoil in the Hisle soil is a limitation. Both soils become compacted if farmed when wet and are difficult to till when dry. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Larvie soil is suited to windbreaks and environmental plantings, but the clayey subsoil restricts the penetration of plant roots. Windbreaks can be established, but optimum growth and survival are unlikely. Planting on the contour helps to control erosion. The Hisle soil generally is unsuited to windbreaks and environmental plantings because of the sodium affected subsoil. No trees and shrubs grow well on this soil.

The Larvie soil is in capability unit IVe-14, Clayey range site, and windbreak suitability group 4C; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

Lo—Lohmiller silty clay. This deep, well drained, nearly level soil is on flood plains. It is subject to rare flooding of brief duration. Areas are irregular in shape and 10 to several hundred acres in size.

Typically, the surface layer is pale brown, calcareous silty clay about 6 inches thick. The underlying material to a depth of 60 inches is pale brown and light gray, calcareous, stratified silty clay, very fine sandy loam, silt loam, and silty clay loam. In places, the underlying material contains more clay and the surface layer is dark gray or gray.

Included with this soil in mapping are small areas of Craft and Haverson soils. These soils make up less than 15 percent of any one mapped area. They contain less clay throughout than the Lohmiller soil. Also, they are nearer the river.

The content of organic matter and fertility are low in the Lohmiller soil. Tilth is poor. Available water capacity is moderate. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing and hay. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Alfalfa, green needlegrass, and pubescent wheatgrass are examples of suitable pasture plants. Measures that improve tilth and fertility and conserve moisture are the main management needs if the soil is cultivated. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Subsoiling or chiseling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings. The trees and shrubs that require an abundant supply of moisture grow especially well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

MhA—Metre-Hisle complex, 0 to 2 percent slopes. These moderately deep, well drained, nearly level soils are on uplands. The Metre soil is on short, convex slopes. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The sodium affected Hisle soil is on flats and in shallow depressions. Areas are irregular in shape and 10 to 200 acres in size. They are 35 to 50 percent Metre soil and 30 to 45 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Metre soil is dark gray clay about 4 inches thick. The subsoil is dark gray and gray, very firm, calcareous clay about 21 inches thick. The underlying material is brown, calcareous clay. It has accumulations of carbonate and gypsum throughout. Light gray, pale red, and weak red, calcareous shale is at a depth of about 37 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is light gray or light brownish gray.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Cactusflat, Orella, and Weta soils. These included soils make up less than 20 percent of any one mapped area. Cactusflat and Weta soils are more than 40 inches deep over bedrock. They are slightly lower on the landscape than the Metre and Hisle soils. Orella soils are less than 20 inches deep over bedrock. They are higher on the landscape than the Metre and Hisle soils.

The content of organic matter is moderate in the Metre soil and low in the Hisle soil. Fertility is medium in the Metre soil and low in the Hisle soil. Tilth is poor in both soils. The Hisle soil has a sodium affected subsoil that restricts root penetration. Available water capability is low in both soils. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted

grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Crested wheatgrass, green needlegrass, alfalfa, and western wheatgrass can be grown on the Metre soil, but very little production can be expected on the Hisle soil. Winter wheat and oats are better suited than grain sorghum. The sodium affected subsoil in the Hisle soil is a limitation. Both soils become compacted if farmed when wet and are difficult to till when dry. Measures that conserve moisture and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Metre soil is suited to windbreaks and environmental plantings, but the clayey subsoil restricts the penetration of plant roots. Windbreaks can be established, but optimum growth and survival are unlikely. The Hisle soil is unsuited to windbreaks and environmental plantings because of the sodium affected subsoil. No trees and shrubs grow well on this soil.

The Metre soil is in capability unit IIIs-3, Clayey range site, and windbreak suitability group 4C; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

MhB—Metre-Hisle complex, 2 to 6 percent slopes. These moderately deep, well drained, gently sloping soils are on uplands. The Metre soil is on short, convex slopes. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The sodium affected Hisle soil is on short, concave slopes. Areas are irregular in shape and 10 to 200 acres in size. They are 35 to 50 percent Metre soil and 30 to 45 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Metre soil is dark gray clay about 4 inches thick. The subsoil is dark gray and gray, very firm, calcareous clay about 21 inches thick. The underlying material is brown, calcareous clay. It has accumulations of carbonates and gypsum throughout. Light gray, pale red, and weak red, calcareous shale is at a depth of about 37 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is light gray or light brownish gray.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Cactusflat, Orella, and Weta soils. These included soils make up less than 20 percent of any one mapped area. Cactusflat and Weta soils are more than 40 inches deep over bedrock. They are slightly lower on the landscape than the Metre and Hisle soils. Orella soils are less than 20 inches deep over bedrock. They are higher on the landscape than the Metre and Hisle soils.

The content of organic matter is moderate in the Metre soil and low in the Hisle soil. Fertility is medium in the Metre soil and low in the Hisle soil. Tilth is poor in both soils. The Hisle soil has a sodium affected subsoil that restricts root penetration. Available water capacity is low in both soils. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. The sodium affected subsoil in the Hisle soil is a limitation. Crested wheatgrass, green needlegrass, alfalfa, and western wheatgrass can be grown on the Metre soil, but very little production can be expected on the Hisle soil. Winter wheat and oats are better suited than grain sorghum. Both soils become compacted if farmed when wet and are difficult to till when dry. Measures that control erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

The Metre soil is suited to windbreaks and environmental plantings, but the clayey subsoil restricts the penetration of plant roots. Windbreaks can be established, but optimum growth and survival are unlikely. The Hisle soil is unsuited to windbreaks and environmental plantings because of the sodium affected subsoil. No trees and shrubs grow well on this soil.

The Metre soil is in capability unit IVe-3, Clayey range site, and windbreak suitability group 4C; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

MoB—Metre-Larvie clays, 2 to 6 percent slopes. These moderately deep, well drained, gently sloping soils are on uplands characterized by gilgai relief. When dry, the soils are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The Metre soil is in swales. The Larvie soil is on low ridges. Areas are irregular in shape and 10 to 400 hundred acres in size. They are 35 to 55 percent Metre soil and 25 to 45 percent Larvie soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Metre soil is dark gray clay about 4 inches thick. The subsoil is dark gray and gray, very firm, calcareous clay about 21 inches thick. The underlying material is brown, calcareous clay. It has accumulations of carbonate and gypsum throughout. Light gray, pale red and weak red, calcareous shale is at a depth of about 37 inches. In places the depth to shale is more than 40 inches.

Typically, the surface layer of the Larvie soil is dark brown, calcareous clay about 5 inches thick. The subsoil is weak red, very firm, calcareous clay about 21 inches thick. It has gypsum crystals in the lower part. Weak red, calcareous shale is at a depth of about 26 inches. It has gypsum crystals in the upper part. In places the depth to shale is more than 40 inches. In some areas the subsoil and the shale are olive or grayish brown.

Included with these soils in mapping are small areas of Conata and Hisle soils. These included soils make up less than 20 percent of any one mapped area. Conata soils are 10 to 20 inches deep over shale. They are on the high parts of the landscape. Hisle soils have a sodium affected subsoil. They are in nearly level areas.

The content of organic matter is moderate in the Metre soil and low in the Larvie soil. Fertility is medium in the Metre soil and low in the Larvie soil. Tilth is poor in both soils. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, pubescent wheatgrass, and western wheatgrass are the best suited pasture plants. Small grain is better suited than row crops. The soils become compacted if farmed when wet and are difficult to till when dry. Measures that control erosion, improve tilth and fertility, and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

These soils are suited to windbreaks and environmental plantings, but the clayey subsoil can restrict root penetration. Windbreaks can be established, but optimum growth and survival are unlikely. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

MyE—Midway silty clay loam, 15 to 40 percent slopes. This shallow, well drained, moderately steep and steep soil is on uplands. Scattered stones and boulders are on the surface in some areas. Slopes are smooth or slightly convex.

Typically, the surface layer is light yellowish brown, calcareous silty clay loam about 6 inches thick. The underlying material is light yellowish brown, calcareous silty clay. Light gray, calcareous, sandy, silty, and clayey shale is at a depth of about 14 inches. In places the underlying material contains more sand.

Included with this soil in mapping are small areas of Hisle and Razor soils. These soils make up less than 15 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are along small drainageways. Razor soils are 20 to 40 inches deep over shale. They are on low side slopes.

The content of organic matter and fertility are low in the Midway soil. Available water capacity also is low. Permeability is slow. Runoff is rapid. The shrink-swell potential is high.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws. Seepage could be a problem.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope and the shallow depth to shale.

The capability unit is VIIe-8; Shallow range site; windbreak suitability group 10.

NkD—Nihill-Samsil complex, 6 to 15 percent slopes. These moderately sloping and strongly sloping soils are on ridges and the sides of entrenched drainageways in the uplands. The deep, excessively drained Nihill soil is on the ridges. The shallow, well drained Samsil soil is on the lower parts of the landscape. Areas are irregular in shape and 10 to several hundred acres in size. They are 30 to 50 percent Nihill soil and 30 to 50 percent Samsil soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nihill soil is grayish brown, calcareous gravelly loam about 9 inches thick. The underlying material to a depth of 60 inches is pale yellow, calcareous very gravelly loam. In places it contains more sand.

Typically, the surface layer of the Samsil soil is grayish brown, calcareous clay about 3 inches thick. The underlying material is light brownish gray, friable, calcareous shaly clay about 8 inches thick. It contains gypsum crystals. Light olive gray, calcareous shale is at a depth of about 11 inches. In some places the surface layer is gravelly clay loam, gravelly clay, or gravelly loam. In other places the underlying material contains more gypsum. In some areas the soil contains less clay throughout.

Included with these soils in mapping are small areas of Nunn and Pierre soils. These included soils make up less than 20 percent of any one mapped area. They contain

less gravel than the Nihill soil and are deeper over shale than the Samsil soil. Nunn soils are on the less sloping uplands above the Nihill soil. Pierre soils are on the lower side slopes.

The content of organic matter and fertility are low in the Nihill and Samsil soils. Available water capacity also is low. Permeability is moderately rapid in the Nihill soil and slow in the Samsil soil. Runoff is rapid on both soils. The shrink-swell potential is low in the Nihill soil and very high in the Samsil soil.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The shallow depth to bedrock or to gravel and the slope are the main limitations.

The Nihill soil is in capability unit VIs-4, Shallow to Gravel range site; the Samsil soil is in capability unit VIe-12, Shallow Clay range site. Both soils are in windbreak suitability group 10.

NoA—Norka silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 10 to 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 10 inches thick. It is grayish brown, friable silty clay loam in the upper part and light brownish gray, very friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In places the underlying material contains more clay. In some areas bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of Cactusflat, Colby, Dawes, Savo, and Weta soils. These soils make up less than 15 percent of any one mapped area. Cactusflat and Savo soils contain more clay in the subsoil than the Norka soil. They are on the low parts of the landscape. Colby soils are not so dark as the Norka soil. They are on the high parts of the landscape. Dawes and Weta soils are in slight depressions. Dawes soils have a dense claypan subsoil. Weta soils have a sodium affected subsoil.

The content of organic matter is moderate and fertility medium in the Norka soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is slow. The shrink-swell potential is moderate in the subsoil and low in the underlying material.

About half of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, and pubescent wheatgrass are examples of suitable pasture plants. Measures that conserve moisture are the main management needs. Examples are leaving crop residue on the surface and minimizing tillage.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

NpD—Norka-Colby silt loams, 6 to 15 percent slopes. These deep, well drained, moderately sloping and strongly sloping soils are on uplands. The Norka soil is on the less sloping, smooth or slightly convex side slopes. The Colby soil is on ridges. Areas are irregular in shape and 10 to several hundred acres in size. They are 35 to 55 percent Norka soil and 25 to 45 percent Colby soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Norka soil is dark grayish brown silt loam about 5 inches thick. The subsoil is about 10 inches thick. It is grayish brown, friable silty clay loam in the upper part and light brownish gray, very friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In some places the subsoil contains less clay. In other places siltstone is within a depth of 40 inches. In some areas the surface layer and subsoil contain more sand.

Typically, the surface layer of the Colby soil is light brownish gray, calcareous silt loam about 6 inches thick. The subsoil is brown and pale brown, friable, calcareous silt loam about 16 inches thick. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silt loam and silty clay loam. In places the surface layer is dark grayish brown or grayish brown. In some areas bedrock is within a depth of 40 inches.

Included with these soils in mapping are small areas of Blackpipe, Dawes, Savo, and Wortman soils. These included soils make up less than 20 percent of any one mapped area. Blackpipe and Savo soils contain more clay in the subsoil than the Norka soil. They are in positions on the landscape similar to those of the Norka soil. Dawes and Wortman soils have a claypan subsoil. They are on concave side slopes and in slight depressions.

The content of organic matter is moderate in the Norka soil and low in the Colby soil. Fertility is medium in the Norka soil and low in the Colby soil. Tilth is good in both soils. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell

potential is moderate in the subsoil of the Norka soil and low in the underlying material. It is low in the Colby soil.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

These soils generally are too steep for cultivated crops. They are suited to tame pasture and hay and to windbreaks and environmental plantings, but the high content of lime in the surface layer of the Colby soil is a limitation. Alfalfa and intermediate wheatgrass are examples of suitable pasture plants. Windbreaks and environmental plantings can be established, but optimum growth and survival are unlikely on the Colby soil. Planting on the contour helps to control erosion.

The capability unit is VIe-1. The Norka soil is in Silty range site, windbreak suitability group 3; the Colby soil is Thin Upland range site, windbreak suitability group 8.

NrC—Norrest-Wanblee complex, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are on uplands. The Norrest soil is in convex areas. The sodium affected Wanblee soil is in slight depressions and other concave areas. Areas are irregular in shape and 10 to several hundred acres in size. They are 40 to 60 percent Norrest soil and 25 to 40 percent Wanblee soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Norrest soil is grayish brown, calcareous silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is light brownish gray and light gray, firm and friable, calcareous silty clay loam and silty clay. Light gray, calcareous siltstone is at a depth of about 28 inches. In places the depth to siltstone is more than 40 inches.

Typically, the surface layer of the Wanblee soil is light brownish gray loam about 2 inches thick. The subsoil is about 27 inches thick. It is light brownish gray and light gray, very firm, firm, and friable clay, clay loam, and loam. In the lower part it is calcareous and has visible salts. White, calcareous siltstone is at a depth of about 29 inches.

Included with these soils in mapping are small areas of Blackpipe, Cactusflat, Cedarpass, Denby, Interior, Orella, Whitewater, and Wortman soils. These included soils make up less than 20 percent of any one mapped area. Blackpipe and Wortman soils have a surface layer that is darker than that of the Norrest and Wanblee soils. Blackpipe soils are in positions on the landscape similar to those of the Norrest soil. Wortman soils are in positions on the landscape similar to those of the Wanblee soil. Cactusflat, Cedarpass, Denby, and Interior soils are more than 40 inches deep over bedrock. Cactusflat and Denby soils are in slight swales. Cedarpass soils are on upland flats. Interior soils are along drainageways. Orella soils are 10 to 20 inches deep over shale. They are on ridges. Whitewater soils contain more clay throughout than the Norrest soil. They are on the low parts of the landscape.

The content of organic matter and fertility are low in the Norrest and Wanblee soils. Tilth is fair in the Norrest soil and poor in the Wanblee soil. The Wanblee soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is low or moderate in the Norrest soil and low in the Wanblee soil. Permeability is moderately slow in the Norrest soil and very slow in the Wanblee soil. Runoff is medium on both soils. The shrink-swell potential is high in the Norrest soil. It is high in the subsoil of the Wanblee soil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem on the Wanblee soil. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. The sodium affected subsoil in the Wanblee soil is a limitation. Alfalfa, intermediate wheatgrass, green needlegrass, and pubescent wheatgrass can be grown on the Norrest soil, but very little production can be expected on the Wanblee soil. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Terraces and grassed waterways help to control erosion.

The Norrest soil is suited to windbreaks and environmental plantings, but the Wanblee soil generally is unsuited. The moderate depth to bedrock in the Norrest soil is a limitation. Windbreaks can be established on this soil, but optimum growth is unlikely. No trees or shrubs grow well on the Wanblee soil. Planting on the contour helps to control erosion.

The Norrest soil is in capability unit IVe-13, Clayey range site, and windbreak suitability group 6R; the Wanblee soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

NuA—Nunn loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on high terraces. Areas are irregular in shape and 10 to 300 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 37 inches thick. It is grayish brown and light brownish gray, firm clay and friable clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. In places shale is at a depth of 20 to 40 inches. In some areas the subsoil contains less sand.

Included with this soil in mapping are small areas of Arvada, Beckton, Pierre, and Promise soils. These soils

make up less than 15 percent of any one mapped area. Arvada and Beckton soils have a sodium affected subsoil. They are in small, shallow depressions. Pierre and Promise soils contain more clay throughout than the Nunn soil. Also, they are slightly lower on the landscape.

The content of organic matter is moderate in the Nunn soil. Fertility is medium. Tilth is good. Available water capacity is moderate or high. Permeability is slow. Runoff also is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

About half the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, and intermediate wheatgrass are examples of suitable pasture plants. Measures that conserve moisture are the main management needs in cultivated areas. Leaving crop residue on the surface and minimizing tillage are examples.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit IIIc-1; Silty range site; windbreak suitability group 3.

NuB—Nunn loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on high terraces. Areas are irregular in shape and 10 to 200 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 37 inches thick. It is grayish brown and light brownish gray, firm clay and friable clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. In places shale is at a depth of 20 to 40 inches. In some areas the subsoil contains less sand.

Included with these soils in mapping are small areas of Arvada, Beckton, Pierre, and Promise soils. These soils make up less than 15 percent of any one mapped area. Arvada and Beckton soils have a sodium affected subsoil. They are in small, shallow depressions and on low side slopes. Pierre and Promise soils contain more clay in the subsoil than the Nunn soil. Also, they are slightly lower on the landscape.

The content of organic matter is moderate in the Nunn soil. Fertility is medium. Tilth is good. Available water capacity is moderate or high. Permeability is slow. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

About half of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system are examples. Terraces and grassed waterways help to control erosion.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit IIIe-1; Silty range site; windbreak suitability group 3.

NuC—Nunn loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on high terraces. Areas are irregular in shape and 10 to 200 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 37 inches thick. It is grayish brown and light brownish gray, firm clay and friable clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. In places shale is at a depth of 20 to 40 inches. In some areas the subsoil contains less sand.

Included with this soil in mapping are small areas of Arvada, Beckton, Nihill, Pierre, and Promise soils. These included soils make up less than 15 percent of any one mapped area. Arvada and Beckton soils have a sodium affected subsoil. They are in shallow depressions and on the concave lower side slopes near drainageways. The gravelly Nihill soils are on ridges. Pierre and Promise soils contain more clay throughout than the Nunn soil. They are on the low parts of the landscape.

The content of organic matter is moderate in the Nunn soil. Fertility is medium. Tilth is good. Available water capacity is moderate or high. Permeability is slow. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, erosion is a hazard along some cattle trails. It can be controlled by fencing and other means of controlling livestock traffic patterns.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue or the surface, minimizing tillage, and including grasses and

legumes in the cropping system. Terraces and grassed waterways help to control erosion.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IVe-1; Silty range site; windbreak suitability group 3.

NuD—Nunn loam, 8 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on high terraces. Areas are irregular in shape and 10 to 200 acres in size. Slopes are long and are smooth or slightly convex.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is about 37 inches thick. It is grayish brown and light brownish gray, firm clay and friable clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. In places shale is at a depth of 20 to 40 inches. In some areas the subsoil contains more sand.

Included with this soil in mapping are small areas of Arvada, Beckton, and Nihill soils. These included soils make up less than 15 percent of any one mapped area. Arvada and Beckton soils have a sodium affected subsoil. They are on flats and foot slopes. The gravelly Nihill soils are on ridges.

The content of organic matter is moderate in the Nunn soil. Fertility is medium. Tilth is good. Available water capacity is moderate or high. Permeability is slow. Runoff is medium. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. Erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This soil generally is unsuited to cultivated crops. It is suited to tame pasture and hay and to windbreaks and environmental plantings, but the slope is a limitation. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is VIe-1; Silty range site; windbreak suitability group 3.

NwB—Nunn-Beckton loams, 2 to 6 percent slopes. These deep, well drained, gently sloping soils are on uplands. The Nunn soil is on smooth or convex slopes. The sodium affected Beckton soil is on short, concave side slopes below the Nunn soil. Areas are irregular in shape and 10 to several hundred acres in size. They are 40 to 60 percent Nunn soil and 25 to 40 percent Beckton soil. The two soils occur as areas so closely intermingled or so small that mapping separately is not practical.

Typically, the surface layer of the Nunn soil is dark grayish brown loam about 5 inches thick. The subsoil is about 37 inches thick. It is grayish brown and light brownish gray, firm clay and friable clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. In places the subsoil contains less sand. In some areas the depth to shale is 20 to 40 inches.

Typically, the surface layer of the Beckton soil is grayish brown loam about 6 inches thick. The subsurface layer is light brownish gray loam about 2 inches thick. The subsoil is about 39 inches thick. It is dark grayish brown and grayish brown, very firm and firm clay and clay loam. In the lower part it is calcareous and contains visible salts. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has visible salts throughout. In places the surface layer is thicker. In some areas the depth to shale is 20 to 40 inches.

Included with these soils in mapping are small areas of Arvada, Hisle, Larvie, Metre, and Pierre soils. These included soils make up less than 20 percent of any one mapped area. Arvada and Hisle soils have a surface layer that is thinner than that of the Beckton soil. They are in positions on the landscape similar to those of the Beckton soil. Larvie, Metre, and Pierre soils contain more clay throughout than the Nunn soil. They are lower on the landscape than the Nunn and Beckton soils.

The content of organic matter is moderate and fertility medium in the Nunn and Beckton soils. Tilth is good in the Nunn soil and poor in the Beckton soil. The Beckton soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is moderate or high in both soils. Permeability is slow in the Nunn soil and very slow in the Beckton soil. Runoff is slow on both soils. The shrink-swell potential is high in the subsoil of the Nunn soil and moderate in the underlying material. It is high in the Beckton soil.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem if the Beckton soil is grazed during wet periods.

These soils are suited to cultivated crops and to tame pasture and hay, but the sodium affected subsoil in the Beckton soil is a limitation. Alfalfa, green needlegrass, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. Measures that improve tilth, control erosion, and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

These soils are suited to windbreaks and environmental plantings, but the sodium affected subsoil in the Beckton soil is a limitation. All climatically suited

trees and shrubs grow well on the Nunn soil, except for those that require an abundant supply of moisture. No trees or shrubs grow well on the Beckton soil.

The Nunn soil is in capability unit IIIe-1, Silty range site, and windbreak suitability group 3; the Beckton soil is in capability unit IVs-2, Claypan range site, and windbreak suitability group 9.

NxD—Nunn-Nihill complex, 6 to 15 percent slopes. These deep, moderately sloping and strongly sloping soils are on uplands. The well drained Nunn soil is on smooth or concave, mid and lower side slopes. The excessively drained Nihill soil is on short, convex ridges and the upper side slopes. Areas are irregular in shape and 10 to 100 acres in size. They are 40 to 60 percent Nunn soil and 25 to 40 percent Nihill soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nunn soil is dark grayish brown loam about 5 inches thick. The subsoil is about 37 inches thick. It is grayish brown and light brownish gray, firm clay and friable clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. In some places shale is at a depth of 20 to 40 inches. In other places the subsoil contains less sand.

Typically, the surface layer of the Nihill soil is grayish brown, calcareous gravelly loam about 9 inches thick. The underlying material to a depth of 60 inches is pale yellow, calcareous very gravelly loam. In some places the depth to shale is 20 to 40 inches. In other places the underlying material contains more sand.

Included with these soils in mapping are small areas of Beckton, Midway, Razor, and Samsil soils. These included soils make up less than 20 percent of any one mapped area. Beckton soils have a sodium affected subsoil. They are on the lower side slopes. Midway and Samsil soils are 10 to 20 inches deep over shale. They are on ridges. Razor soils are 20 to 40 inches deep over shale. They are lower on the landscape than the Nunn soil.

The content of organic matter is moderate in the Nunn soil and low in the Nihill soil. Fertility is medium in the Nunn soil and low in the Nihill soil. Available water capacity is moderate or high in the Nunn soil and low in the Nihill soil. Permeability is slow in the Nunn soil and moderately rapid in the Nihill soil. Runoff is rapid on both soils. The shrink-swell potential is high in the subsoil of the Nunn soil and moderate in the underlying material. It is low in the Nihill soil.

Most of the acreage supports native grasses and is used for grazing. Erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This map unit generally is unsuited to cultivated crops and hay because of the slope of both soils and the shallow depth to gravel in the Nihill soil. The Nunn soil can be used for tame pasture and hay or for environmental plantings. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. All climatically suited trees and shrubs grow well on the Nunn soil, except for those that require an abundant moisture supply. No trees or shrubs grow well on the Nihill soil.

The Nunn soil is in capability unit VIe-1, Silty range site, and windbreak suitability group 3; the Nihill soil is in capability unit VIs-4, Shallow to Gravel range site, and windbreak suitability group 10.

OrE—Orella-Rock outcrop complex, 3 to 45 percent slopes. This map unit occurs as areas of a shallow, well drained, gently sloping to moderately steep Orella soil intermingled with areas of Rock outcrop. The unit is on uplands. The Orella soil is on wide ridges and side slopes. In some areas scattered stones are on the surface. The Rock outcrop occurs as mounds and escarpments. Areas are irregular in shape and 10 to several hundred acres in size. They are 40 to 50 percent Orella soil and 30 to 40 percent Rock outcrop. The Orella soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Orella soil is light gray, calcareous clay loam about 3 inches thick. The next 6 inches is light gray, very firm, calcareous clay. The underlying material is light gray, calcareous clay. It has common fragments of shale. Light gray and very pale brown, calcareous shale is at a depth of about 14 inches. In places the depth to shale is less than 10 inches.

The Rock outcrop occurs as exposures of bedrock of the Brule, Chadron, and Pierre Formations. The Brule Formation consists mainly of siltstone and rises almost vertically to a height of 100 feet or more. The Chadron and Pierre Formations consist of clayey shale and are domelike. The Chadron Formation is light gray and red, and the Pierre Formation is light brown and olive.

Included in this map unit in mapping are small areas of Cedarpass, Denby, Interior, Norrest, Wanblee, and Whitewater soils. These included soils make up less than 20 percent of any one mapped area. Cedarpass, Denby, Interior, and Norrest soils are more than 20 inches deep over bedrock. Cedarpass, Denby, and Norrest soils are on small mesas. Interior soils are in drainageways. Wanblee soils have a sodium affected subsoil. They are on the high parts of the landscape. The moderately deep Whitewater soils are on foot slopes below the Orella soil.

The content of organic matter is very low and fertility low in the Orella soil. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is high.

In all areas the Orella soil supports native grasses and is used for grazing. Water erosion is a hazard. Gullies

form along some cattle trails. Reestablishing vegetation is difficult in denuded areas. The Rock outcrop supports little or no vegetation.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The slope, the shallow depth to shale, and the Rock outcrop are limitations.

The Orella soil is in capability unit VIIe-5, Shallow Clay range site, and windbreak suitability group 10; the Rock outcrop is in capability unit VIIIs-2 and is not assigned to a range site or a windbreak suitability group.

PcB—Pierre clay, 3 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, firm and very firm clay about 30 inches thick. The underlying material is pale olive shaly clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the surface layer is dark grayish brown. In some areas the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Arvada, Hisle, Nunn, and Samsil soils. These soils make up less than 15 percent of any one mapped area. Arvada and Hisle soils have a sodium affected subsoil. Arvada soils are along drainageways. Hisle soils are on foot slopes. The deep Nunn soils contain less clay and more sand in the subsoil than the Pierre soil. They generally are on the high parts of the landscape. Samsil soils are 6 to 20 inches deep over shale. They are on the steeper slopes above the Pierre soil.

The content of organic matter and fertility are low in the Pierre soil. Tilth is poor. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

About half of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Alfalfa, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples of suitable pasture plants. Winter wheat and oats are the main crops. Measures that conserve moisture, control erosion, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Terraces, grassed waterways, and stripcropping help to control erosion. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings, but it takes in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

PcC—Pierre clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, firm and very firm clay about 30 inches thick. The underlying material is pale olive shaly clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the surface layer is dark grayish brown. In some areas the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Arvada, Hisle, Nunn, and Samsil soils. These included soils make up less than 15 percent of any one mapped area. Arvada and Hisle soils have a sodium affected subsoil. They are in slightly concave areas and along drainageways. Nunn and Samsil soils are on the high parts of the landscape. The deep Nunn soils contain less clay and more sand in the subsoil than the Pierre soil. Samsil soils are 6 to 20 inches deep over shale.

The content of organic matter and fertility are low in the Pierre soil. Tilth is poor. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Alfalfa, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples of suitable pasture plants. Winter wheat and oats are the main crops. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways help to control erosion.

Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings, but it takes in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IVe-4; Clayey range site; windbreak suitability group 4C.

PhB—Pierre-Hisle complex, 1 to 6 percent slopes. These moderately deep, well drained, gently sloping soils are on uplands. The Pierre soil is on smooth or convex slopes. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The sodium affected Hisle soil is on short, concave side slopes and on flats below the Pierre soil. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 60 percent Pierre soil and 20 to 40 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, firm and very firm clay about 30 inches thick. The underlying material is pale olive clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is dark grayish brown.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It contains visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Nunn and Samsil soils. These included soils make up less than 20 percent of any one mapped area. They are on the high parts of the landscape. Nunn soils contain less clay and more sand in the subsoil than the Pierre soil. Samsil soils are 6 to 20 inches deep over shale.

The content of organic matter and fertility are low in the Pierre and Hisle soils. Tilth is poor. The Hisle soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is low in both soils. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass can be grown on the Pierre soil, but no pasture plants grow well on the Hisle soil. Winter wheat and oats are better suited than grain sorghum. Both soils become compacted if farmed when wet and are difficult to till when dry. The sodium affected subsoil in the Hisle soil is a limitation. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Pierre soil is suited to windbreaks and environmental plantings, but the Hisle soil generally is unsuited. The clayey subsoil in the Pierre soil can restrict root penetration. Trees and shrubs can be planted on this soil, but optimum survival and growth are unlikely. No trees or shrubs grow well on the Hisle soil.

The Pierre soil is in capability unit IIIe-4, Clayey range site, and windbreak suitability group 4C; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

PkD—Pierre-Samsil clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Pierre soil is on side slopes. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through to the subsoil. The shallow Samsil soil is on ridges and sharp slope breaks. In some areas scattered stones are on the surface. Areas are irregular in shape and are 10 to several thousand acres in size. They are 45 to 60 percent Pierre soil and 25 to 35 percent Samsil soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, very firm clay about 30 inches thick. The underlying material is pale olive shaly clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the surface layer is dark grayish brown. In some areas the depth to shale is more than 40 inches.

Typically, the surface layer of the Samsil soil is grayish brown, calcareous clay about 3 inches thick. The underlying material is light brownish gray, friable, calcareous shaly clay. It has gypsum crystals throughout. Light olive gray, calcareous shale is at a depth of about 11 inches. It has gypsum crystals in the upper part. In places the underlying material contains less clay.

Included with these soils in mapping are small areas of Hisle, Nunn, and Wendte soils. These included soils make up less than 20 percent of any one mapped area.

Hisle soils have a sodium affected subsoil. They are on low side slopes. Nunn and Wendte soils are more than 40 inches deep over shale. The loamy Nunn soils are on high ridges. The stratified Wendte soils are on narrow flood plains.

The content of organic matter and fertility are low in the Pierre and Samsil soils. Tilth is poor. Available water capacity is low. Permeability is very slow in the Pierre soil and slow in the Samsil soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing (fig. 10). Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws. Seepage could be a problem.

These soils generally are too steep or too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The less sloping areas of the Pierre soil, however, can be seeded to tame pasture plants. If special management is applied, they also can be used for hand-planted trees and shrubs grown for special purposes

The Pierre soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C; the Samsil soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10.

PrA—Promise clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 100 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray clay about 5 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very firm, calcareous clay about 33 inches thick. It has gypsum crystals in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It contains gypsum crystals throughout. In places shale is at a depth of 20 to 40 inches. In some areas the surface layer is light brownish gray.

Included with this soil in mapping are small areas of Hurley and Nunn soils. These soils make up less than 15 percent of any one mapped area. The sodium affected Hurley soils are on the low parts of the landscape. Nunn soils have less clay throughout than the Promise soil. They are in positions on the landscape similar to those of the Promise soil.

The content of organic matter is moderate and fertility medium in the Promise soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay, but it becomes compacted if farmed when wet and is difficult to till when dry. Alfalfa, green needlegrass, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Measures that control wind erosion, improve tilth, and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, stripcropping, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

If this soil is used for range, compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings, but it takes in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IIIs-3; Clayey range site; windbreak suitability group 4C.

PsA—Promise-Hurley complex, 0 to 3 percent slopes. These deep, nearly level soils are on uplands. The well drained Promise soil is in smooth, slightly convex areas. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The moderately well drained, sodium affected Hurley soil is in shallow depressions and on low side slopes. Areas are irregular in shape and 10 to 100 acres in size. They are 50 to 60 percent Promise soil and 20 to 30 percent Hurley soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Promise soil is dark gray clay about 5 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very firm, calcareous clay about 33 inches thick. It has gypsum crystals in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It has gypsum crystals throughout. In places the surface layer is light brownish gray. In some areas shale is at a depth of 20 to 40 inches.

Typically, the surface layer of the Hurley soil is light gray silt loam about 2 inches thick. The subsoil is dark gray, gray, and light brownish gray, firm and very firm clay about 31 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, light gray, and light brownish gray, calcareous clay. It has nests of visible salts throughout.

Included with these soils in mapping are small areas of the stratified Wendte soils on narrow flood plains. These included soils make up less than 20 percent of any one mapped area.

The content of organic matter is moderate in the Promise soil and low in the Hurley soil. Fertility is medium in the Promise soil and low in the Hurley soil. Tilth is poor in both soils. The Hurley soil has a sodium affected subsoil that restricts root penetration. Available

water capacity is moderate or low in both soils. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples of pasture plants suited to the Promise soil. No pasture plants are suited to the Hurley soil. Measures that control wind erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, stripcropping, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Promise soil is suited to windbreaks and environmental plantings, but the Hurley soil generally is unsuited. The clayey subsoil in the Promise soil can restrict the penetration of plant roots. Windbreaks can be established on this soil, but optimum survival and growth are unlikely. No trees or shrubs grow well on the Hurley soil.

The Promise soil is in capability unit IIIs-3, Clayey range site, and windbreak suitability group 4C; the Hurley soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

PsB—Promise-Hurley complex, 3 to 6 percent slopes. These deep, gently sloping soils are on uplands. The well drained Promise soil is in convex areas. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The moderately well drained, sodium affected Hurley soil is on side slopes and in slight depressions. Areas are irregular in shape and 10 to 300 acres in size. They are 45 to 55 percent Pierre soil and 25 to 35 percent Hurley soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Promise soil is dark gray clay about 5 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very firm, calcareous clay about 33 inches thick. It has gypsum crystals in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It has gypsum crystals throughout. In places the surface layer is light brownish gray. In some areas shale is at a depth of 20 to 40 inches.

Typically, the surface layer of the Hurley soil is light gray silt loam about 2 inches thick. The subsoil is dark gray, gray, and light brownish gray, firm and very firm clay about 31 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is gray, light gray, and light brownish gray, calcareous clay. It has nests of visible salts throughout.

Included with these soils in mapping are small areas of the stratified Wendte soils on narrow flood plains. These soils make up less than 20 percent of any one mapped area.

The content of organic matter is moderate in the Promise soil and low in the Hurley soil. Fertility is medium in the Promise soil and low in the Hurley soil. Tilth is poor in both soils. The Hurley soil has a sodium affected subsoil that restricts root penetration. Available water capacity is moderate or low in both soils. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass are examples of pasture plants suited to the Promise soil. No pasture plants are suited to the Hurley soil. Measures that control erosion, conserve moisture, and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, stripcropping, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Promise soil is suited to windbreaks and environmental plantings, but the Hurley soil generally is unsuited. The clayey subsoil in the Promise soil can restrict the penetration of plant roots. Windbreaks can be established on this soil, but optimum growth and survival are unlikely. No trees or shrubs grow well on the Hurley soil.

The Promise soil is in capability unit IIIe-4, Clayey range site, and windbreak suitability group 4C; the Hurley soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

PuB—Promise-Pierre clays, 3 to 6 percent slopes. These well drained, gently sloping soils are on uplands. When dry, they are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The deep Promise soil is on smooth side slopes. The moderately deep Pierre soil is on ridges and the upper side slopes. Areas are irregular in shape and 10 to 1,000 acres in size. They are 40 to 55 percent Promise soil and 25 to 40 percent Pierre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer or the Promise soil is dark gray clay about 5 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, very firm, calcareous clay about 33 inches thick. It has gypsum crystals in the lower part. The underlying

material to a depth of 60 inches is light brownish gray, calcareous clay. It has gypsum crystals throughout.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, firm and very firm clay about 30 inches thick. The underlying material is pale olive shaly clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the surface layer is dark grayish brown.

Included with these soils in mapping are small areas of Hurley and Nunn soils. These included soils make up less than 20 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are in slight depressions and along drainageways. Nunn soils contain less clay throughout than the Promise and Pierre soils. They are in positions on the landscape similar to those of the Promise soil.

The content of organic matter is moderate in the Promise soil and low in the Pierre soil. Fertility is medium in the Promise soil and low in the Pierre soil. Tilth is poor in both soils. Available water capacity is moderate or low in the Promise soil and low in the Pierre soil. Permeability is very slow in both soils. Runoff is medium. The shrink-swell potential is very high.

About half of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay, but they become compacted if farmed when wet and are difficult to till when dry. Alfalfa, green needlegrass, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Small grain and grain sorghum are the main crops. Measures that control erosion, improve tilth, and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grass and legumes in the cropping system. Chiseling or subsoiling increases the rate of water intake and improves tilth.

These soils are suited to windbreaks and environmental plantings, but they take in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IIIe-4; Clayey range site; windbreak suitability group 4C.

PuC—Promise-Pierre clays, 6 to 9 percent slopes. These well drained, moderately sloping soils are on uplands. When dry, they are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. The deep Promise soil is on the lower side slopes. The moderately deep Pierre soil is on the upper side slopes and on ridges. Areas are irregular in shape and 10 to several hundred acres in size. They are 35 to 50 percent Promise soil and 30 to 45 percent Pierre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Promise soil is dark gray clay about 5 inches thick. The subsoil is dark grayish brown, grayish brown, light brownish gray, very firm, calcareous clay about 33 inches thick. It has gypsum crystals in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay. It has gypsum crystals throughout.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, firm and very firm clay about 30 inches thick. The underlying material is pale olive shaly clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the surface layer is dark grayish brown.

Included with these soils in mapping are small areas of Hurley, Nunn, and Samsil soils. These included soils make up less than 20 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are on the lower side slopes near drainageways. Nunn soils contain less clay throughout than the Promise and Pierre soils. They are in positions on the landscape similar to those of the Promise soil. Samsil soils are 6 to 20 inches deep over shale. They are on ridges.

The content of organic matter is moderate in the Promise soil and low in the Pierre soil. Fertility is medium in the Promise soil and low in the Pierre soil. Tilth is poor in both soils. Available water capacity is moderate or low in the Promise soil and low in the Pierre soil. Permeability is very slow in both soils. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay, but they become compacted if farmed when wet and are difficult to till when dry. Alfalfa, green needlegrass, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. Small grain is the main crop. Measures that control erosion, improve tilth, and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling increases the rate of water intake and improves tilth. Terraces and grassed waterways help to control erosion.

These soils are suited to windbreaks and environmental plantings, but they take in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum

growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-4; Clayey range site; windbreak suitability group 4C.

RhC—Razor-Hisle complex, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are on uplands. The Razor soil is on smooth or convex slopes. The sodium affected Hisle soil is on short, concave side slopes and in slight depressions. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 60 percent Razor soil and 25 to 40 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Razor soil is grayish brown silty clay loam about 3 inches thick. The subsoil is grayish brown, light yellowish brown, and light gray, friable and firm silty clay loam about 30 inches thick. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 33 inches. In some places the depth to shale is more than 40 inches. In other places the surface layer contains less clay. In some areas the surface layer is dark grayish brown. In other areas the slope is as much as 12 percent.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the depth to shale is more than 40 inches. In some areas the upper part of the subsoil is dark grayish brown.

Included with these soils in mapping are small areas of Beckton Variant, Emigrant, Midway, Nunn, and Pierre soils. These included soils make up less than 20 percent of any one mapped area. Beckton Variant soils have a surface layer that is thicker than that of the Hisle soil. Also, they are slightly higher on the landscape. Emigrant and Nunn soils have more sand in the subsoil than the Razor soil. They are on wide ridges above the Razor soil. Midway soils are less than 20 inches deep over shale. They are on ridges above the Razor and Hisle soils. Pierre soils contain more clay throughout than the Razor soil. They are on the lower parts of the landscape.

The content of organic matter and fertility are low in the Razor and Hisle soils. Tilth is fair in the Razor soil and poor in the Hisle soil. The Hisle soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is low in both soils. Permeability is slow in the Razor soil and very slow in the Hisle soil. Runoff is medium on both soils. The shrink-swell potential is high in the Razor soil and very high in the Hisle soil.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem on the Hisle soil. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

The Razor soil is suited to cultivated crops and to tame pasture and hay, but the Hisle soil generally is unsuited. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. Winter wheat and oats are better suited than grain sorghum. The soils become compacted if farmed when wet and are difficult to till when dry. The sodium affected subsoil in the Hisle soil is a limitation. Measures that control erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage. Chiseling or subsoiling increases the rate of water intake and improves tilth. Contour farming, grassed waterways, and terraces help to control erosion.

The Razor soil is suited to windbreaks and environmental plantings, but the Hisle soil generally is unsuited. No trees or shrubs grow well on the Hisle soil. Planting on the contour helps to control erosion.

The Razor soil is in capability unit IVe-14, Clayey range site, and windbreak suitability group 4C; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

RmD—Razor-Midway silty clay loams, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Razor soil is on the mid and lower, smooth or convex side slopes. The shallow Midway soil is on ridges and sharp slope breaks. Scattered stones and boulders are on the surface in some areas. Areas are irregular in shape and 10 to several hundred acres in size. They are 40 to 60 percent Razor soil and 30 to 40 percent Midway soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Razor soil is grayish brown silty clay loam about 3 inches thick. The subsoil is grayish brown, light yellowish brown, and light gray, friable and firm silty clay loam about 30 inches thick. It is calcareous in the lower part. Light gray, calcareous shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches.

Typically, the surface layer of the Midway soil is light yellowish brown, calcareous silty clay loam about 6 inches thick. The underlying material is light yellowish brown, calcareous silty clay. Light gray, calcareous, sandy, silty, and clayey shale is at a depth of about 14 inches. In places the surface layer and subsoil contain more sand.

Included with these soils in mapping are small areas of Arvada, Beckton Variant, Emigrant, Hisle, and Pierre soils. These included soils make up less than 20 percent

of any one mapped area. Arvada, Beckton Variant, and Hisle soils have a sodium affected subsoil. They are on the lower side slopes along drainageways. Emigrant soils have a surface layer that is darker than that of the Razor soil. Also, they contain more sand in the subsoil. They are in positions on the landscape similar to those of the Razor soil. Pierre soils contain more clay throughout than the Razor soil. They are on the low parts of the landscape.

The content of organic matter and fertility are low in the Razor and Midway soils. Available water capacity is low. Permeability is slow. Runoff is rapid. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws. Seepage could be a problem.

These soils generally are too steep or too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The less sloping areas of the Razor soil, however, can be seeded to tame pasture plants. If special management is applied, they also can be used for hand-planted trees and shrubs grown for special purposes.

The Razor soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C; the Midway soil is in capability unit VIe-12, Shallow range site, and windbreak suitability group 10.

SaF—Samsil clay, 15 to 40 percent slopes. This shallow, well drained, moderately steep and steep soil is on uplands. Scattered stones are on the surface in some areas. Areas are irregular in shape and 100 to more than 1,000 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is grayish brown, calcareous clay about 3 inches thick. The underlying material is light brownish gray, friable, calcareous shaly clay. It has gypsum crystals throughout. Light olive gray, calcareous shale is at a depth of about 11 inches. It has gypsum crystals in the upper part. In places the soil contains less clay throughout. In some areas the surface layer is gravelly clay loam.

Included with this soil in mapping are small areas of Hisle, Pierre, and Wendte soils and areas of Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The sodium affected Hisle soils and the moderately deep Pierre soils are on foot slopes. The stratified Wendte soils are along drainageways. The Rock outcrop commonly is on ridges and the upper side slopes. It supports little or no vegetation.

The content of organic matter and fertility are low in the Samsil soil. Available water capacity also is low. Permeability is slow. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Gullies form along some cattle trails. Reestablishing vegetation is difficult in denuded areas.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The slope and the shallow depth to shale are limitations.

The capability unit is VIIe-8; Shallow Clay range site; windbreak suitability group 10.

ShE—Samsil-Hisle-Rock outcrop complex, 6 to 25 percent slopes. These moderately sloping to moderately steep, well drained soils and areas where shale crops out are on uplands. The shallow Samsil soil is on ridges and the upper side slopes. The sodium affected Hisle soil is on the lower side slopes and along drainageways. The Rock outcrop is on convex slopes. Areas are irregular in shape and 10 to 300 acres in size. They are 25 to 35 percent Samsil soil, 25 to 30 percent Hisle soil, and 15 to 25 percent Rock outcrop. These two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Samsil soil is grayish brown, calcareous clay about 3 inches thick. The underlying material is light brownish gray, friable, calcareous shaly clay. It has gypsum crystals throughout. Light olive gray, calcareous shale is at a depth of about 11 inches. It has gypsum crystals in the upper part. In some areas the surface layer and underlying material are not calcareous.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the depth to shale is more than 40 inches.

The Rock outcrop is shale bedrock of the Pierre Formation. It does not support vegetation. It occurs as dome-shaped exposures and as outcrops intermingled with the Samsil soil. In places scattered iron concretions are on the surface.

Included in this unit in mapping are small areas of Beckton, Kyle, Pierre, Valent, and Wortman soils. These included soils make up less than 20 percent of any one mapped area. Beckton and Wortman soils have a surface layer that is thicker than that of the Hisle soil. They are slightly higher on the landscape than the Hisle soil. Kyle and Pierre soils are more than 20 inches deep over shale and do not have a sodium affected subsoil.

They are in the less sloping areas. The sandy Valent soils are on some ridges.

The content of organic matter and fertility are low in the Hisle and Samsil soils. Tilth is poor. The Hisle soil has a sodium affected subsoil that adversely affects the penetration of plant roots. Available water capacity is low in both soils. Permeability is slow in the Samsil soil and very slow in the Hisle soil. Runoff is rapid on the Samsil soil and medium on the Hisle soil. The shrink-swell potential is very high in both soils.

In all areas the Samsil and Hisle soils support native grasses and are used for grazing. The Rock outcrop does not support grazable vegetation. Water erosion is a hazard. Gullies form along some cattle trails. Reestablishing vegetation is difficult.

This map unit is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Rock outcrop is an additional limitation.

The Samsil soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Rock outcrop is in capability unit VIIIs-2 and is not assigned to a range site or a windbreak suitability group.

SpE—Samsil-Pierre clays, 15 to 25 percent slopes. These well drained, moderately steep soils are on uplands where drainageways are deeply entrenched. Scattered stones are on the surface in some areas. The shallow Samsil soil is on ridges and the upper side slopes. The moderately deep Pierre soil is on the lower parts of the landscape. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to several thousand acres in size. They are 40 to 60 percent Samsil soil and 30 to 40 percent Pierre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Samsil soil is grayish brown, calcareous clay about 3 inches thick. The underlying material is light brownish gray, friable, calcareous shaly clay. It has gypsum crystals throughout. Light olive gray, calcareous shale is at a depth of about 11 inches. It has gypsum crystals in the upper part. In some areas the surface layer is gravelly clay loam. In places the soil contains less clay throughout.

Typically, the surface layer of the Pierre soil is grayish brown clay about 4 inches thick. The subsoil is grayish brown and pale olive, very firm and firm clay about 30 inches thick. The underlying material is pale olive shaly clay. It has gypsum crystals throughout. The soil is calcareous throughout. Pale yellow and gray, calcareous shale is at a depth of about 37 inches. In places the surface layer is dark grayish brown. In some areas the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Hisle, Hurley, and Wendte soils and Rock outcrop. These included soils and Rock outcrop make up less than 20 percent of any one mapped area. Hisle and Hurley soils have a sodium affected subsoil. They are on the lower side slopes near drainageways. The Rock outcrop commonly is on ridges and the upper side slopes. It supports little or no vegetation. The deep, stratified Wendte soils are along narrow drainageways.

The content of organic matter and fertility are low in the Samsil and Pierre soils. Available water capacity also is low. Permeability is slow in the Samsil soil and very slow in the Pierre soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing (fig. 10). Water erosion is a hazard. Gullies form along some cattle trails. Reestablishing vegetation is difficult in denuded areas.

These soils generally are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIe-12; the Samsil soil is in Shallow Clay range site, the Pierre soil in Clayey range site; both soils are in windbreak suitability group 10.

SrF—Samsil-Rock outcrop complex, 25 to 60 percent slopes. This map unit occurs as areas of a shallow, well drained, steep and very steep Samsil soil intermingled with areas of Rock outcrop. The unit is on uplands. Deeply entrenched drainageways are in most areas. The Samsil soil generally is on the steep parts of the landscape. The Rock outcrop generally on the very steep, convex parts. Areas are long and narrow and are 10 to 150 acres in size. They are 50 to 60 percent Samsil soil and 20 to 30 percent Rock outcrop. The Samsil soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Samsil soil is grayish brown, calcareous clay about 3 inches thick. The underlying material is light brownish gray, friable, calcareous shaly clay. It has gypsum crystals throughout. Light olive gray, calcareous shale is at a depth of about 11 inches. It has gypsum crystals in the upper part. In places the surface layer is gravelly clay loam.

The Rock outcrop is shale bedrock of the Pierre Formation. It does not support vegetation.

Included with the Samsil soil and Rock outcrop in mapping are small areas of Hurley, Pierre, and Wendte soils. These included soils make up less than 15 percent of any one mapped area. Hurley soils have a sodium affected subsoil. They are on foot slopes. The moderately deep Pierre soils are on low side slopes. The stratified Wendte soils are along narrow drainageways.

The content of organic matter and fertility are low in the Samsil soil. Available water capacity also is low.

Figure 10.—An area of Samsil-Pierre clays, 15 to 25 percent slopes, used for range.

Permeability is slow. Runoff is rapid. The shrink-swell potential is very high.

In all areas the Samsil soil supports native grasses and is used for grazing. The Rock outcrop does not support grazable vegetation. Water erosion is a hazard. Gullies form along some cattle trails. Reestablishing vegetation is difficult.

This map unit is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Rock outcrop is an additional limitation.

The Samsil soil is in capability unit VIIe-8, Shallow Clay range site, and windbreak suitability group 10; Rock outcrop is in capability unit VIIIs-2 and is not assigned to a range site or a windbreak suitability group.

SwB—Savo-Dawes silt loams, 2 to 6 percent slopes. These deep, gently sloping soils are on uplands. The well drained Savo soil is on the high parts of the landscape. The moderately well drained Dawes soil is in slight depressions and swales. Areas are irregular in shape and 10 to 800 acres in size. They are 50 to 60 percent Savo soil and 25 to 35 percent Dawes soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Savo soil is grayish brown silt loam about 5 inches thick. The subsoil is grayish brown, brown, and light gray, firm and friable silty clay loam about 37 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam. In places bedrock is at a depth of 20 to 40 inches. In some areas the subsoil contains more sand.

Typically, the surface layer of the Dawes soil is grayish brown silt loam about 7 inches thick. The subsurface layer is light brownish gray silt loam about 3 inches thick. The subsoil is about 31 inches thick. It is grayish brown, firm silty clay and light brownish gray and light gray,

friable and firm, calcareous silty clay loam. The underlying material to a depth of 60 inches is light gray, calcareous silt loam. In places the subsoil contains salt crystals.

Included with these soils in mapping are small areas of Cactusflat, Colby, Kolls, Norka, and Weta soils. These included soils make up less than 20 percent of any one mapped area. The well drained Cactusflat and Weta soils formed in sodium-rich material. They are in positions on the landscape similar to those of the Dawes soil. Colby and Norka soils contain less clay in the subsoil than the Savo soil. They are in positions on the landscape similar to those of the Savo soil. The poorly drained Kolls soils are in depressions.

The content of organic matter is moderate and fertility medium in the Savo and Dawes soils. Tilth is good. Available water capacity is high. Permeability is moderately slow in the Savo soil. It is slow in the subsoil of the Dawes soil and moderate in the underlying material. Runoff is slow on both soils. The shrink-swell potential is high in the Savo soil. It is high in the subsoil of the Dawes soil and moderate in the underlying material.

Most of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, green needlegrass, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants. Measures that control erosion and conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The Savo soil is in capability unit IIIe-1, Silty range site, and windbreak suitability group 3; the Dawes soil is in capability unit IVe-9, Silty range site, and windbreak suitability group 9.

VwC—Valent-Wortman loamy fine sands, 3 to 9 percent slopes. These undulating and gently rolling soils are on uplands. The deep, excessively drained Valent soil is on the higher parts of the landscape. The moderately deep, well drained, sodium affected Wortman soil is on the low parts. Areas are irregular in shape and 10 to 300 acres in size. They are 40 to 60 percent Valent soil and 20 to 40 percent Wortman soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Valent soil is light brownish gray loamy fine sand about 5 inches thick. The underlying material to a depth of 60 inches is light gray fine sand. In places the surface layer is grayish brown or brown. In some areas the underlying material is calcareous. In other areas bedrock is at a depth of 20 to 40 inches.

Typically, the surface layer of the Wortman soil is grayish brown loamy fine sand about 5 inches thick. The subsurface layer is gray loamy fine sand about 5 inches thick. The subsoil is about 19 inches thick. It is grayish brown, light gray, and light brownish gray, very firm and firm sandy clay and clay. In the lower part it is calcareous and has accumulations of salts and carbonate. The underlying material is light gray and gray, calcareous clay loam. It has salt crystals in the upper part. Light gray and white, calcareous siltstone is at a depth of about 36 inches. In places the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Hisle, Orella, Samsil, and Wanblee soils, sand blowouts, and Slickspots. These inclusions make up less than 20 percent of any one mapped area. The sodium affected Hisle and Wanblee soils have a thin surface layer. They are in swales and small depressions. Orella and Samsil soils are less than 20 inches deep over bedrock. They are on some ridges. Sand blowouts and Slickspots do not support vegetation. They are in pits and depressions. In some areas they are ponded in the spring and after periods of heavy rainfall.

The content of organic matter is low in the Valent soil and moderate in the Wortman soil. Fertility is low in the Valent soil and medium in the Wortman soil. Available water capacity is low in both soils. The Wortman soil has a sodium affected subsoil that restricts the penetration of plant roots. Permeability is very rapid in the Valent soil and very slow in the Wortman soil. Runoff is slow on both soils. The shrink-swell potential is low in the Valent soil and high in the Wortman soil.

Most of the acreage supports native grasses and is used for grazing. Wind erosion is a hazard. Sand blowouts are likely to form in overgrazed areas. Reestablishing vegetation is difficult in denuded areas.

These soils generally are too sandy for cultivated crops and tame pasture and hay. Evergreen trees can be planted in sod in areas of the Valent soil. The sodium affected subsoil is a limitation affecting trees and shrubs planted in the Wortman soil.

The Valent soil is in capability unit VIe-10, Sands range site, and windbreak suitability group 7; the Wortman soil is in capability unit VIs-5, Sandy range site, and windbreak suitability group 9.

Wb—Wendte clay. This deep, moderately well drained, nearly level soil is on flood plains. It is subject to rare flooding of brief duration. Areas are irregular in shape and 10 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous clay about 8 inches thick. The underlying material to a depth of 60 inches is grayish brown, calcareous, stratified clay and silty clay. In some places it contains less clay. In other places it is not so stratified. In some areas the surface layer is light gray or pale brown.

Included with this soil in mapping are small areas of Arvada and Hurley soils. These soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil. They are on foot slopes near the adjacent uplands.

The content of organic matter is moderate and fertility medium in the Wendte soil. Tilth is poor. Available water capacity is moderate or high. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, smooth bromegrass, and western wheatgrass are examples of suitable pasture plants. Winter wheat, grain sorghum, and oats are the main crops. In some years flooding delays fieldwork. The soil becomes compacted if farmed when wet and is difficult to till when dry. Measures that improve tilth and conserve moisture during dry periods are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system.

In areas used for range, compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey underlying material can restrict the penetration of plant roots.

The capability unit is IIIs-3; Clayey Overflow range site; windbreak suitability group 4C.

Wc—Wendte clay, channeled. This deep, moderately well drained, nearly level soil is on flood plains that are dissected into many small tracts by narrow channels. It is occasionally flooded for brief periods. Areas are long and narrow and are 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous clay about 8 inches thick. The underlying material to a depth of 60 inches is grayish brown, calcareous, stratified clay and silty clay. In places it is not so stratified. In some areas the surface layer is light gray or pale brown.

Included with this soil in mapping are small areas of Absted, Arvada and Hurley soils near the uplands. These soils make up less than 15 percent of any one mapped area. They have a sodium affected subsoil.

The content of organic matter is high and fertility medium in the Wendte soil. Tilth is poor. Available water capacity is moderate or high. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Although the occasional flooding is a hazard, the additional water is beneficial. Pools of water in some areas of the channel provide temporary watering sites for livestock and wildlife. In some areas native trees and shrubs provide habitat for wildlife and protection for livestock in winter.

Because of the meandering channels, this soil generally is unsuited to cultivated crops. In areas that are accessible to farm machinery, it is suited to tame pasture and hay. Alfalfa, green needlegrass, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants. In some years debris deposited by floodwater damages pasture plants and hinders haying.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey underlying material can restrict the penetration of plant roots. Because of the meandering stream channels, the trees and shrubs cannot be planted by machine. They can be planted by hand.

The capability unit is VIw-1; Clayey Overflow range site; windbreak suitability group 4C.

WeA—Weta silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level, sodium affected soil is on uplands and fans. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is light brownish gray silt loam about 2 inches thick. The subsoil is about 28 inches thick. It is dark gray and gray, very firm silty clay in the upper part and light gray and light brownish gray, friable, calcareous silty clay loam in the lower part. It has visible salts and accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam and silt loam. It has accumulations of carbonates and salts in the upper part. In some areas the subsoil has a lower content of salts. In other areas the surface layer is thicker. In some places the underlying material contains more sand. In other places bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Blackpipe, Cactusflat, and Norka soils. These soils make up less than 15 percent of any one mapped area. They do not have a sodium affected subsoil. They are higher on the landscape than the Weta soil.

The content of organic matter is moderate in the Weta soil. Fertility is low. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. Available water capacity is moderate. Permeability is slow in the subsoil and moderately slow in the underlying material. Runoff is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is generally unsuited to cultivated crops, but it is suited to tame pasture and hay. Crested wheatgrass and pubescent wheatgrass are examples of suitable pasture plants. The thin surface layer, the dense, compacted subsoil, and the accumulations of sodium salts are limitations.

This soil generally is unsuited to windbreaks and environmental plantings. The dense claypan subsoil is a limitation. No trees or shrubs grow well.

The capability unit is VIs-3; Thin Claypan range site; windbreak suitability group 10.

WhA—Whitewater clay, 0 to 3 percent slopes. This moderately deep, well drained, nearly level, sodium-rich soil is on uplands. When dry, it is characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to several hundred acres in size. Slopes are long and smooth.

Typically, the surface layer is light gray clay about 3 inches thick. The subsoil is light gray, gray, and light brownish gray, very firm clay and shaly clay about 25 inches thick. It has accumulations of carbonate and visible salts in the lower part. The soil is calcareous throughout. Light gray, calcareous shale is at a depth of about 28 inches. In some areas the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Denby, Hisle, and Orella soils. These soils make up less than 15 percent of any one mapped area. Denby soils contain less clay throughout than the Whitewater soil and are more than 40 inches deep over bedrock. They are in positions on the landscape similar to those of the Whitewater soil. Hisle soils have a sodium affected subsoil. They are in small depressions. Orella soils are 10 to 20 inches deep over shale. They are on convex slopes above the Whitewater soil.

The content of organic matter and fertility are low in the Whitewater soil. Tilth is very poor. Available water capacity is low. Permeability is very slow. Runoff is moderate. The shrink-swell potential is very high.

Nearly all areas support native grasses and are used for grazing (fig. 11). Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The dense, clayey surface layer and subsoil restrict the penetration of roots.

The capability unit is VIs-6; Dense Clay range site; windbreak suitability group 10.

WsC—Wortman-Hisle complex, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping to moderately sloping, sodium affected soils are on uplands. The Wortman soil is on smooth side slopes and ridges. The Hisle soil is in small depressions. Areas generally are long and narrow but in places are irregular in shape. They are 10 to 400 acres in size. They are 40 to 60 percent Wortman soil and 20 to 40 percent Hisle soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Wortman soil is grayish brown loamy fine sand about 5 inches thick. The subsurface layer is gray loamy fine sand about 5 inches thick. The subsoil is about 19 inches thick. It is grayish brown, light brownish gray, and light gray, very firm and firm sandy clay and clay. In the lower part it is calcareous and has accumulations of salts and carbonate. The underlying material is light gray and gray, calcareous clay loam. It has salt crystals in the upper part. Light gray and white, calcareous siltstone is at a depth of about 36 inches. In places the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Hisle soil is grayish brown silt loam about 1 inch thick. The subsoil is grayish brown and light brownish gray, firm clay about 14 inches thick. In the lower part it is calcareous and has visible salts. The underlying material is pale olive, calcareous clay and shaly clay. It has visible salts throughout. Light gray, calcareous shale is at a depth of about 26 inches. It has visible salts in the upper part. In places the depth to shale is more than 40 inches.

Included with these soils in mapping are small areas of Conata, Emigrant, Larvie, Nunn, Pierre, and Valent soils and Slickspots. These inclusions make up less than 20 percent of any one mapped area. They do not have a sodium affected subsoil. Conata and Valent soils are on some ridges. Emigrant, Larvie, Nunn, and Pierre soils are in positions on the landscape similar to those of the Wortman soil. Slickspots are in small depressions. They do not support vegetation.

The content of organic matter is moderate in the Wortman soil and low in the Hisle soil. Fertility is medium in the Wortman soil and low in the Hisle soil. Tilth is good in the Wortman soil and poor in the Hisle soil. The sodium affected subsoil in both soils restricts the penetration of plant roots. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is high in the Wortman soil and very high in the Hisle soil.

Most of the acreage supports native grasses and is used for grazing. The Wortman soil is subject to wind erosion. Compaction is a problem on the Hisle soil. Reestablishing vegetation is difficult in denuded areas.

This map unit is poorly suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Alfalfa, intermediate wheatgrass, and

Figure 11.—An area of Whitewater clay, 0 to 3 percent slopes, used for range.

pubescent wheatgrass can be grown on the Wortman soil, but very little production can be expected on the Hisle soil. The sodium affected subsoil in both soils is a limitation. Trees and shrubs can be established on the Wortman soil, but optimum growth is unlikely. No trees or shrubs grow well on the Hisle soil.

The Wortman soil is in capability unit VIs-5, Sandy range site, and windbreak suitability group 9; the Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 19 percent of the acreage in the survey area is used for cultivated crops or for tame pasture and hay (*3*). Winter wheat is the main crop. Alfalfa, oats, grain sorghum, and sudangrass also are grown. Alfalfa is harvested mainly for hay. Sorghum and winter wheat are grown as cash crops, and oats is grown as a cash crop and as livestock feed. The normal cropping system is winter wheat followed by a year of fallow. The fallow period is used to conserve moisture for the next growing season.

About 26,000 acres of potentially good cropland is currently used as range (*9*). In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the county.

Water erosion reduces productivity and results in sedimentation. It is a hazard on Emigrant, Nunn, Promise and other soils if the slope is more than 2 percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Kyle, Pierre, and Razor soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Emigrant, Pierre, and Razor soils. When erosion occurs, sediment rich in nutrients enters streams, lakes, and reservoirs. Measures that control erosion minimize this pollution and preserve water quality for fish and other wildlife and for recreation uses. They also reduce the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an

amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions reduce the runoff rate and help to control erosion by reducing the length of slopes. They are most practical on deep, well drained soils that have long, smooth slopes, such as Kyle, Nunn, and Promise soils. Some of the soils in the survey area are poorly suited to terraces because of short, irregular slopes or an unfavorable subsoil, which would be exposed in terrace channels. Grassed waterways are effective in controlling gully erosion.

Wind erosion is a slight or moderate hazard on many of the soils in the survey area. The hazard is severe on Kyle, Norrest, Pierre, Promise, and Razor soils. Wind erosion can damage these soils in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. It can be controlled by an adequate plant cover, a cover of crop residue, stripcropping, and tillage methods that keep the surface rough. Windbreaks of suitable trees and shrubs also are effective in controlling wind erosion.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil fertility helps to determine the yields that can be obtained from the soil. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. On soils that have a high content of lime in the surface layer, the kinds and amounts of fertilizer needed generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. On all soils additions of fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous. In Kyle, Larvie, Pierre, and Promise soils, tilth is poor. Tilth also is poor in soils that have a claypan subsoil, such as Beckton and Wortman soils. These soils dry out slowly in the spring and cannot be easily tilled when dry. If they are farmed when wet, they tend to be very cloddy when dry. As a result of the cloddiness, preparing a seedbed is difficult. Timely tillage, inclusion of grasses and legumes in the cropping system, and incorporation of crop residue into the soil improve tilth and increase the rate of water intake.

Field crops suited to the soils and climate of the survey area include small grain and row crops. Winter wheat and oats are the main small grain crops. Barley and spring wheat are grown on a lesser acreage. The main row crop is grain sorghum. Corn is grown on a small acreage. Most of the corn is harvested for silage.

Winter wheat is planted in areas that have been summer fallowed. The soils best suited to field crops are more than 40 inches deep over bedrock and receive additional moisture as runoff from the surrounding uplands. Absted, Beckton, Dawes, and other soils that have a claypan subsoil are better suited to early maturing small grain than to other crops. These soils tend to be droughty late in the growing season because the claypan subsoil restricts root penetration and the rate of water intake.

Pasture plants best suited to the climate and most of the soils in the survey area include alfalfa, intermediate wheatgrass, and crested wheatgrass. Bunch grasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent. Pubescent wheatgrass is suited to Beckton and other soils that have a claypan subsoil.

If the pasture is overgrazed, the grasses lose vigor and die and usually are replaced by annual grasses and weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local

office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*7*). These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 or IVs-2.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups."

Rangeland

Rod Baumberger, range conservationist, Soil Conservation Service, helped prepare this section.

Range is land on which the native vegetation consists mainly of grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes areas where the native vegetation has been reestablished. The amount and kind of native vegetation grown in any one area are determined by the soil, topography, climate, past use, and management.

All of the survey area was range before the first permanent settlers arrived. Approximately 81 percent of the survey area currently supports native vegetation. Range supplies a major portion of the forage for the livestock in the survey area.

Approximately 68 percent of the farm and ranch income in the survey area is derived from the sale of livestock. Most of the ranches are cow-calf enterprises, but some are yearling enterprises. Also, some ranches combine cow herds with yearlings. The range generally is grazed throughout the year. Protein concentrates and hay supplement winter grazing. Tame pasture plants, such as crested wheatgrass and intermediate wheatgrass, also supplement the forage provided by native plants.

The survey area is part of the mixed-grass prairie. The native vegetation is dominated by mid and short grasses and forbs, but some tall grasses are also mixed in with these plants. This mixed-grass prairie is made up of cool- and warm-season plants that provide good forage throughout the growing season. The cool-season plants grow mainly during April, May, and June and warm-season plants during June, July, and August. The cool-season grasses can start growing again in September and October if fall rains are adequate.

The Badlands, in the southwestern part of the survey area, are characterized by very steep areas of Rock

outcrop. Scattered stands of Rocky Mountain juniper grow in areas where some soil formation has taken place.

The native vegetation in some parts of the survey area is producing below its potential because of past misuse. Many of the tall grasses and some of the mid grasses have been replaced by short grasses. As a result, the total amount of available forage has been reduced. In most areas the original high-quality plants can be reestablished if good grazing management is applied.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce native vegetation. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important. Soils that produce approximately the same kinds, amounts, and proportions of native vegetation make up a range site. The potential native vegetation on a range site is the stabilized plant community that the site is capable of producing. It consists of the plants that were growing when the region was settled. This plant community maintains itself and changes very little as long as the environment remains unchanged. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map.

The plants within a native plant community are sometimes grouped as decreasers, increasers, or invaders, depending on their response to grazing pressure. *Decreasers* are plants that respond to overgrazing by decreasing in production. They generally are the most productive plants and the ones most preferred by the grazing animals. *Increasers* are plants that respond to grazing pressure, at least initially, by increasing in amount as the more desirable decreaser plants become less productive. Increasers generally are less productive and less preferred by grazing animals. *Invaders* are plants that are not part of the original plant community but invade because of some kind of disturbance or continued overgrazing. Some invaders have little value as forage plants. Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others.

Table 6 shows, for nearly all soils, the range site and the total annual production of vegetation in favorable, average, and unfavorable years. *Potential annual production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures made growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management helps to maintain forage production and provides wildlife habitat, water, and watershed protection. The primary objective of good range management is to keep the range in excellent or good condition. The main management concern is responding to important changes in the plant community on a range site.

Range condition is ascertained by comparing the present vegetation on a range site with the potential native plant community for that site. Four range condition classes are recognized. The range site is in *excellent* condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation, in *good* condition if the percentage is 51 to 75, in *fair* condition if the percentage is 26 to 50, and in *poor* condition if the percentage is 25 or less. The potential productivity of range depends on the range site, the range condition, and the amount of moisture available to plants during the growing season.

Measures that maintain or improve the range condition are needed on all the range in the survey area. These include proper stocking rates and a rotation grazing or deferred grazing program in which the proper sequence of grazing and rest periods helps to maintain or improve the vigor of the key plants. Other measures are range seeding, fencing, watering facilities, and mechanical treatment.

A total of 16 range sites are recognized in the survey area. They are Badland Overflow, Clayey, Clayey Overflow, Claypan, Closed Depression, Dense Clay, Loamy Terrace, Sands, Sandy, Shallow, Shallow Clay, Shallow to Gravel, Silty, Subirrigated, Thin Claypan, and Thin Upland. The paragraphs that follow describe these range sites.

Badland Overflow range site. The potential native vegetation on this site is an excellent stand of mid and short grasses. Warm-season grasses make up about 55 percent of the vegetation and cool-season grasses about 40 percent. Sideoats grama, little bluestem, buffalograss, and blue grama are the main warm-season grasses. The cool-season grasses are mainly western wheatgrass and lesser amounts of green needlegrass and needleandthread. The vegetation on this site varies with

the frequency and the extent of soil deposition by floodwater.

The major management concern on this site is maintaining the extent of the most productive grasses. Overgrazing and flooding decrease the extent of western wheatgrass, little bluestem, and sideoats grama and increase the extent of broom snakeweed, blue grama, weeds, and bare ground. Threeawn and cocklebur are common invaders. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Clayey range site. The potential native vegetation on this site is mid and short prairie grasses interspersed with a variety of forbs and shrubs. Green needlegrass and western wheatgrass make up about 65 percent of the vegetation. Warm-season grasses make up about 25 percent. They include blue grama, sideoats grama, buffalograss, little bluestem, and big bluestem. Forbs, such as American vetch, scurfpea, and yarrow, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. Green needlegrass and western wheatgrass lose their productive capacity after continued overgrazing because the livestock prefer these plants. If overgrazing continues, western wheatgrass and green needlegrass are replaced by buffalograss and blue grama. The extent of the most productive grasses can be maintained by proper stocking rates. Other management includes rotation or deferred grazing. Mechanical treatment is needed in some areas.

Clayey Overflow range site. The potential native vegetation on this site is a stand of mid and tall grasses. Cool-season grasses make up about 90 percent of the vegetation. They are mainly western wheatgrass and lesser amounts of green needlegrass. Short grasses, such as buffalograss and blue grama, are in the understory. Forbs and woody species are not of major importance when this site is in excellent condition.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, western wheatgrass is replaced by buffalograss, blue grama, and weeds. Japanese brome and cocklebur are common invaders. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Western wheatgrass, the dominant cool-season grass, makes up about 40 percent of the vegetation. Needleandthread and green needlegrass make up about 15 percent. Warm-season grasses, such as blue grama, buffalograss, prairie sandreed, and sideoats grama, make up about 35 percent. Silver sagebrush, pricklypear, and forbs, such as sagewort, broom snakeweed, and American vetch, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, western wheatgrass, green needlegrass, prairie sandreed, and sideoats grama decrease in extent and blue grama, buffalograss, and forbs increase. The result is low forage production. If overgrazing continues, a considerable amount of the surface is bare, especially during droughty periods. The extent of the most productive grasses can be maintained by proper stocking rates in combination with a rotation or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Closed Depression range site. The potential native vegetation on this site is mid grasses. Western wheatgrass makes up about 85 percent of the vegetation. Kentucky bluegrass, sedges, rushes, and inland saltgrass make up the remainder. In the wetter areas, the amount of western wheatgrass is higher and the amount of rushes, sedges, and inland saltgrass is lower.

The major management concern on this site is maintaining the extent of western wheatgrass. After continued overgrazing, this grass is replaced by rushes and weeds. The extent of western wheatgrass can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Dense Clay range site. The potential native vegetation on this site is mid prairie grasses interspersed with forbs. Western wheatgrass makes up about 70 percent of the vegetation. Green needlegrass, another cool-season grass, makes up about 20 percent. Forbs, such as wild onion and American vetch, make up about 10 percent. This site usually does not have an understory of short grasses.

The major management concern on this site is maintaining the extent of green needlegrass and western wheatgrass. After continued overgrazing, these grasses thin out and are replaced by unpalatable plants or the surface is bare. Erosion is a serious problem in the bare areas. The extent of green needlegrass and western wheatgrass can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Loamy Terrace range site. The potential native vegetation on this site is mixed prairie grasses. Western wheatgrass and green needlegrass, the major cool-season grasses, make up about 70 percent of the vegetation. Needleandthread makes up about 10 percent. Warm-season grasses, such as big bluestem, prairie sandreed, blue grama, and buffalograss, make up

about 25 percent. The remaining vegetation consists of sedges, sagewort, rose, big sagebrush, and silver sagebrush. Scattered cottonwoods and shrubs provide protection for livestock. They also provide wildlife habitat.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, western wheatgrass, green needlegrass, big bluestem, and prairie sandreed thin out and the extent of buffalograss, blue grama, forbs, and woody plants increases. The extent of the most productive grasses can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Sands range site. The potential native vegetation on this site is mainly warm-season, tall and mid grasses. These grasses make up about 80 percent of the vegetation, as follows: little bluestem, 20 percent; sand bluestem and big bluestem, 30 percent; prairie sandreed, 20 percent; sand dropseed, 5 percent; and an understory of blue grama and sedges, 5 percent. Needleandthread and western wheatgrass make up about 10 percent of the vegetation. Forbs and woody plants, such as leadplant, rose, and sandcherry, make up the remainder. Where the site occurs as areas of the Bankard Variant soil, the vegetation is primarily cottonwoods, willows, and annual plants.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overuse, the bluestems and prairie sandreed are replaced by sand dropseed and blue grama. If overuse continues, green sagewort, sandbur, and bare areas increase in extent. Wind erosion is a serious problem in the bare areas. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Sandy range site. The potential native vegetation on this site is mixed prairie grasses, chiefly mid and tall grasses. The principal warm-season grasses are little bluestem, sand bluestem, big bluestem, blue grama, and prairie sandreed. They make up about 55 percent of the vegetation. Needleandthread and western wheatgrass make up about 30 percent. The remaining vegetation is scurfpea, sagewort, and other forbs.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, the bluestems and prairie sandreed are replaced by needleandthread and western wheatgrass. If overuse continues, these cool-season grasses are replaced by sand dropseed, threadleaf sedge, blue grama, and pricklypear. Under these conditions, sagewort commonly increases in extent. The result is low forage production. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Shallow range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses make up about 70 percent of the vegetation, as follows: little bluestem, 40 percent; sideoats grama, 20 percent; big bluestem, 5 percent; and blue grama and prairie sandreed, 5 percent. Cool-season grasses, such as needleandthread and western wheatgrass, make up about 15 percent of the vegetation. Other plants, such as sedges, forbs, and shrubs, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, little bluestem and big bluestem decrease in extent and needleandthread and sideoats grama increase. If overgrazing continues, the extent of sideoats grama and needleandthread decreases. The result is a sparse stand of sedges, blue grama, and weedy forbs. The extent of the most productive grasses can be maintained by proper stocking rates in combination with rotation grazing or timely deferment of grazing.

Shallow Clay range site. The potential native vegetation on this site is mixed warm- and cool-season prairie grasses. Western wheatgrass and green needlegrass make up about 45 percent of the vegetation. Warm-season grasses, such as sideoats grama, little bluestem, and blue grama, make up about 45 percent. Forbs, such as scurfpea, sagewort, and blacksamson, make up about 5 percent. The remainder is shrubs, particularly skunkbush sumac.

The major management concern on this site is maintaining the extent of the most productive grasses. If the site is overgrazed, the extent of green needlegrass and little bluestem decreases because the livestock prefer these plants. If overgrazing continues, western wheatgrass and sideoats grama also decrease in extent and blue grama and unpalatable forbs increase. The extent of the most productive plants can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Shallow to Gravel range site. The potential native vegetation on this site is mixed prairie grasses. Needleandthread makes up about 25 percent of the vegetation. Other grasses are blue grama and hairy grama, 15 percent; little bluestem, 10 percent; sideoats grama, 10 percent; green needlegrass, 5 percent; western wheatgrass, 5 percent; and threadleaf sedge, 20 percent. Forbs, such as prairie clover, blacksamson, dotted gayfeather, and heath aster, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, needleandthread, little

bluestem, sideoats grama, green needlegrass, and western wheatgrass decrease in extent and threadleaf sedge, blue grama, hairy grama, and forbs increase. If overgrazing continues, bare areas are common. The extent of the most productive grasses can be maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Silty range site. Cool-season grasses make up about 65 percent of the potential native vegetation on this site. Green needlegrass, western wheatgrass, and needleandthread are the major grasses. Warm-season grasses, such as sideoats grama, little bluestem, prairie sandreed, buffalograss, and blue grama, make up about 25 percent of the vegetation. Shrubs and forbs, such as sagewort, heath aster, yarrow, and Missouri goldenrod, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overuse, western wheatgrass, green needlegrass, and needleandthread are replaced by buffalograss, blue grama, sagewort, and threadleaf sedge. The result is low forage production. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Subirrigated range site. The potential native vegetation on this site is a stand of tall prairie grasses. Warm-season grasses, such as big bluestem, prairie cordgrass, and switchgrass, make up about 40 percent of the vegetation. Western wheatgrass, the major cool-season grass, makes up about 50 percent. Kentucky bluegrass, inland saltgrass, and sedges usually are in the understory. The site has scattered clumps of willows and cottonwoods.

The major management concern on this site is maintaining the extent of the most productive tall grasses. Flooding and overgrazing decrease the extent of the tall, warm-season grasses and increase the extent of Kentucky bluegrass, western wheatgrass, and sedges. If overgrazing continues, Kentucky bluegrass, inland saltgrass, annual grasses, and weeds dominate the site. The result is low forage production. The extent of the most productive tall grasses can be maintained by proper stocking rates in combination with a rotation or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Thin Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Short, warm-season grasses dominate the site. Blue grama makes up about 40 percent of the vegetation and buffalograss about 15 percent. Needleandthread and mid, cool-season grasses, such as western wheatgrass, make up about 30 percent. Pricklypear, sagebrush, and forbs, such as sagewort and broom snakeweed, make up the remainder.

The major management concern on this site is maintaining the extent of western wheatgrass and needleandthread. After continued overgrazing, these grasses are replaced by blue grama, buffalograss, and inland saltgrass. If overgrazing continues, a considerable amount of the surface is bare, especially during dry periods. Weeds increase in extent during wet periods. The extent of the desirable grasses can be maintained or increased by proper stocking rates in combination with timely deferment of grazing or rotation grazing.

Thin Upland range site. The potential native vegetation on this site is mixed prairie grasses. Cool-season grasses, such as needleandthread, make up about 30 percent of the vegetation. Warm-season grasses, such as prairie sandreed, sideoats grama, and little bluestem, make up about 30 percent. Blue grama and threadleaf sedge, the major understory plants, make up about 30 percent. Woody plants and forbs, such as sagewort, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. Needleandthread, western wheatgrass, and little bluestem decrease in extent after overgrazing. If overgrazing continues, sedges and blue grama dominate the site. The result is low forage production. The extent of the most productive grasses can be increased or maintained by proper stocking rates in combination with timely deferrment of grazing or rotation grazing.

Native Woods, Windbreaks, and Environmental Plantings

Sheridan I. Dronen, forester, Soil Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 2,500 acres in the survey area, generally on the flood plains along the White and Bad Rivers and along small creeks and drainageways. Cottonwoods are the dominant species on the Craft-Bankard Variant complex and in oxbows on the flood plains along the White River. Sandbar willow grows in low areas adjacent to the White River. Many areas of the Haverson-Craft complex on the flood plains along the White River support stands of cottonwood, green ash, American elm, and chokecherry. Some areas of this complex have been cleared and are used for cultivated crops or alfalfa.

The creeks in the western part of the survey area flow out of the Badlands. As a result, alluvium high in content of sodium is deposited on the flood plains. Scattered clumps of cottonwood, green ash, American plum, snowberry, and rose grow on the Interior soils near the channels of these creeks.

The creeks that empty into the Bad River generally drain areas high in content of clay. Wendte clay, channeled, is the main soil along these drainageways. About half of the acreage in these areas supports trees and shrubs. The main species are green ash, boxelder, cottonwood, peachleaf willow, chokecherry, American plum, buffaloberry, skunkbush sumac, and rose. Many of the shrub species have been depleted because of overgrazing.

The early settlers valued the woody vegetation as a source of fuel and food. Most of the wooded areas currently provide protection for livestock in winter and are used as habitat for wildlife.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect gardens and furnish habitat for wildlife. Several rows of broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before seedlings can be established. Complete weed control is essential to establish and maintain a good windbreak. Cultivation and the application of herbicides are effective methods of controlling weeds.

Grazing is extremely damaging to windbreaks because the livestock compact the soil and remove the lower branches of the trees and shrubs. Removal of the lower branches reduces the effectiveness of the windbreaks.

At the end of each map unit description, the soil has been assigned to a windbreak suitability group. These groups are based primarily on suitability of the soil for locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the survey area are provided in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not

wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Connie M. Vicuna, biologist, Soil Conservation Service, prepared this section.

Wildlife resources in the survey area are abundant and diverse. The most common wildlife species are those that require rangeland habitat, which is a mixture of grassland, woody draws, and wooded areas along streams or rivers. Of these species, those that are most important for hunting include mule deer, white-tailed deer, antelope, sharp-tailed grouse, jackrabbit, and coyote. Other species include fox, badger, bobcat, and prairie dogs.

The common birds on the rangeland habitat include magpie, upland sandpiper, lark bunting, eastern and western kingbirds, mountain bluebirds, and many other songbirds. Raptors are abundant throughout areas of rangeland. Those that are common in this survey area are great horned owls, burrowing owls, short-eared owls, and American kestrel. Ferruginous hawks and golden eagles are less common.

Several waterfowl species migrate through the survey area, but only mallard, gadwall, pintails, and blue-winged teal regularly nest near stock ponds. Giant Canada geese, which have been introduced in the survey area, commonly nest around the stock ponds.

Woody habitat in the survey area is primarily on bottom land, along drainageways, and in draws. The larger areas of woody cover provide habitat for porcupine, squirrel, raccoon, and turkey. While not abundant, the scattered areas of shrubs and trees are critical to many rangeland species as sources of food and cover. Management that protects and improves these areas is needed. It is particularly effective when combined with proper management of the surrounding grassland.

Cropland provides habitat for white-tailed deer, pheasants, and gray partridge. Fishing is available in several small reservoirs, in many private stock dams, and in the White River. Parts of the Badlands National Monument and the Buffalo Gap National Grasslands are within the survey area. They provide abundant protected habitat for wildlife (fig. 12).

Because of the topographic units that they represent and the similar capabilities of their soils to produce and maintain vegetation, soil associations provide some indication of the actual and potential distribution and density of wildlife and their habitat. The 14 associations in the survey area are described under the heading "General Soil Map Units."

Antelope and deer are throughout the survey area. Antelope are most abundant in the open and more nearly level areas of the Hisle-Larvie and Nunn-Beckton-Hisle associations. Mule deer are most abundant in the scattered wooded draws and broken terrain of the Badland-Interior-Cedarpass and Samsil-Pierre associations. Sharp-tailed grouse are common in the areas of grassland intermixed with wooded draws that are characteristic of the Samsil-Pierre, Nunn-Pierre, and Emigrant-Razor-Midway associations.

Wildlife habitat can be improved or developed by maintaining the existing plant cover, by promoting the natural establishment of desirable plants, or by planting appropriate vegetation. The amount and distribution of the food, cover, and water required by the desired wildlife species are important considerations. Also of primary importance is the capability of the soils to produce and maintain the required habitat elements.

In table 9, the soils in the survey area are rated according to their potential for providing specific elements of wildlife habitat. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element. The element can be established, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element are very severe and that unsatisfactory results can be expected. Establishing, improving, or maintaining the element is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil

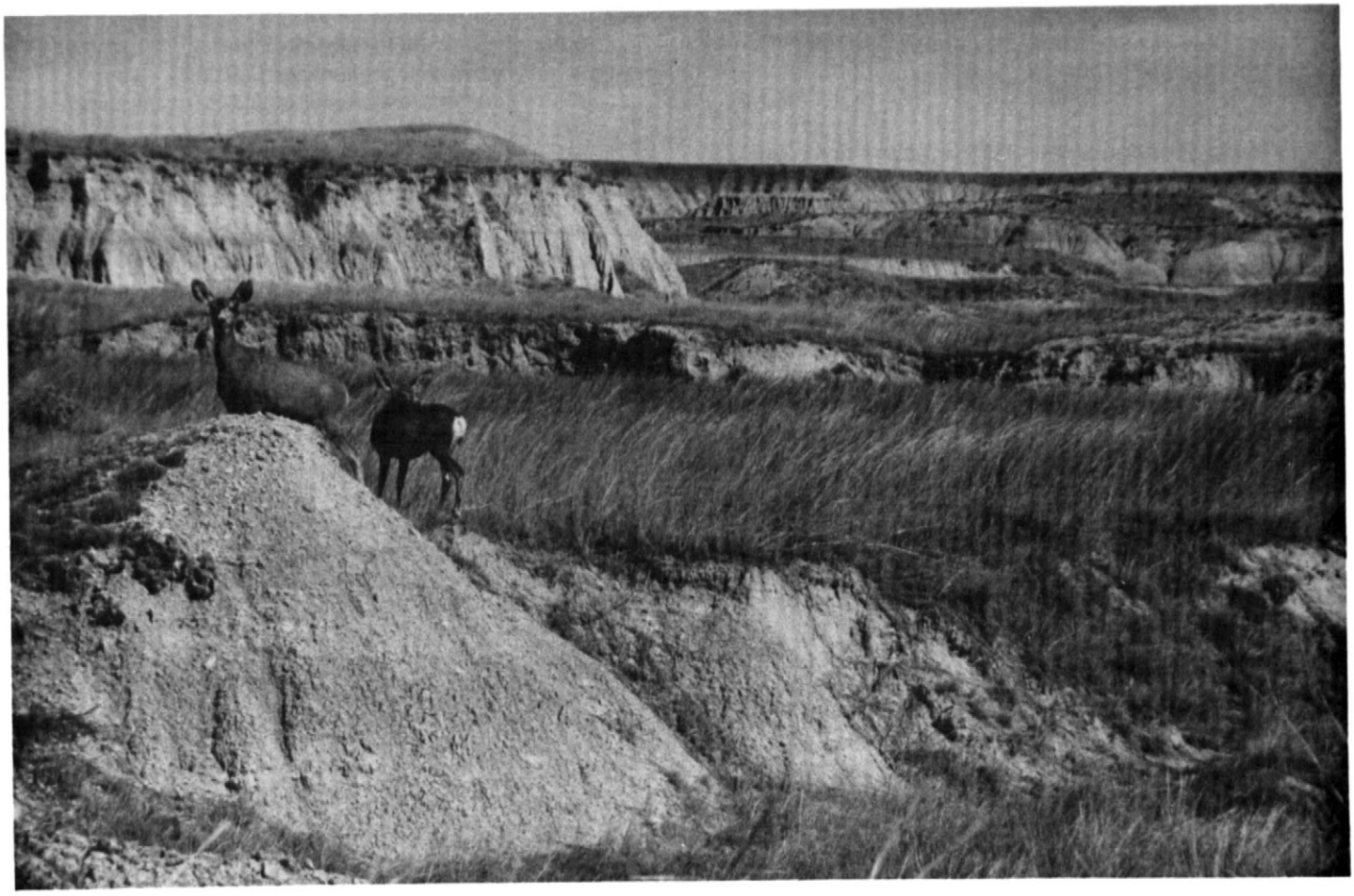

Figure 12.—Mule deer in an area of the Interior-Cedarpass-Badland complex, 0 to 6 percent slopes.

moisture are also considerations. Examples of grain and seed crops are corn, sorghum, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Planted hardwood trees and woody understory produce nuts or other fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are cottonwood, chokecherry, plum, hawthorn, and dogwood.

Native coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Native shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are buffaloberry, plum, snowberry, and sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

Native hardwood trees are trees that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of native hardwood trees are depth of root zone, available water capacity, and wetness. Examples of these trees are ash, chokecherry, cottonwood, and oak.

Information concerning the habitat elements needed to maintain and manage habitat for specific wildlife species can be obtained from the local office of the Soil Conservation Service or from the South Dakota Department of Game, Fish and Parks.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and

observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary Facilities

Table 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3

feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Table 13 also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the

construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 13). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

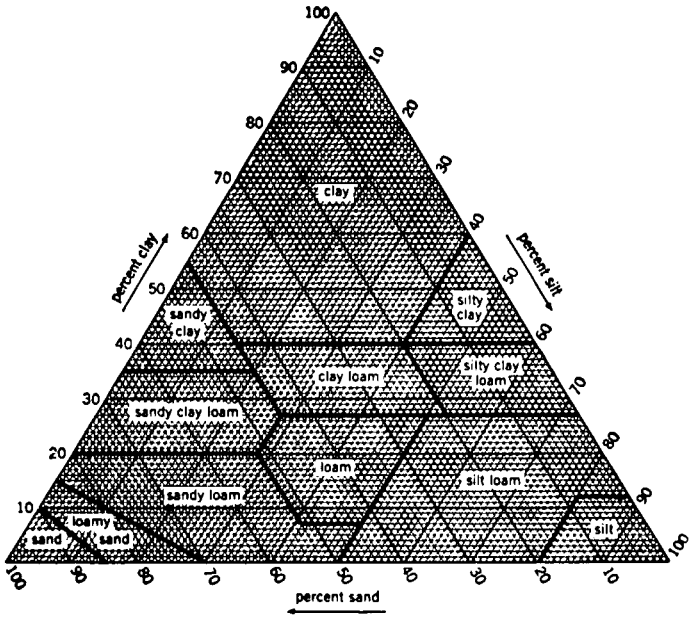

Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in

group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates

are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days.

Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the South Dakota Department of Highways.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (T3Argi, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that is drier than is typical for the great group. An example is Aridic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, mesic Aridic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*6*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*8*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Absted Series

The Absted series consists of deep, well drained soils formed in alluvium on terraces. Permeability is slow. Slopes range from 0 to 3 percent.

Typical pedon of Absted silt loam, 2,300 feet north and 1,250 feet east of the southwest corner of sec. 1, T. 2 S., R. 21 E.

E—0 to 3 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak thin and medium platy structure; soft, very friable; many fine and medium roots; slightly acid; abrupt smooth boundary.

Bt1—3 to 6 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong fine and medium columnar structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; mildly alkaline; clear wavy boundary.

Bt2—6 to 10 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; common fine and medium roots; mildly alkaline; clear wavy boundary.

Btk—10 to 18 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, firm, sticky and plastic; few fine and medium roots; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Cz—18 to 29 inches; light gray (2.5Y 7/2) silty clay, grayish brown (10YR 5/2) moist; massive; very hard, firm, sticky and plastic; few fine and medium accumulations of carbonate; many fine accumulations of salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—29 to 39 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky and plastic; few fine accumulations of carbonate; common fine accumulations of salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—39 to 60 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; common fine accumulations of salts; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 12 inches. The E horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It dominantly is silt loam but in some pedons is loam. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. The content of clay in this horizon ranges from 35 to 50 percent. The C horizon has hue of 10YR to 5Y. It is moderately alkaline to very strongly alkaline.

Arvada Series

The Arvada series consists of deep, well drained soils formed in loamy and clayey sediments along drainageways on uplands. Permeability is very slow. Slopes range from 0 to 2 percent.

Typical pedon of Arvada loam, in an area of Arvada-Slickspots complex, 490 feet east and 1,660 feet south of the northwest corner of sec. 21, T. 2 S., R. 23 E.

E—0 to 2 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—2 to 4 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; light brownish gray (10YR 6/2) coatings on tops of columns; strong medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; common fine flat roots; moderately alkaline; clear wavy boundary.

Bt2—4 to 12 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; common fine flat roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkz1—12 to 18 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine and medium accumulations of salts and carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkz2—18 to 27 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; common fine and medium accumulations of salts and carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—27 to 52 inches; light gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; massive; hard, very firm, sticky and plastic; few or common fine accumulations of salts and carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2—52 to 60 inches; white (2.5Y 8/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; massive; hard, friable; few fine and medium accumulations of salts and carbonate; violent effervescence; moderately alkaline.

The depth to free carbonates ranges from 4 to 12 inches. The E horizon has value of 5 or 6 (4 or 5 moist). It dominantly is loam but in some pedons is fine sandy loam. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is clay or clay loam. It is moderately alkaline to very strongly alkaline. The C horizon also is moderately alkaline to very strongly alkaline. It has hue of 2.5Y or 10YR. It is clay, clay loam, or silty clay loam.

Bankard Variant

The Bankard Variant consists of deep, well drained soils formed in alluvium on flood plains. Permeability is rapid. Slopes range from 0 to 2 percent.

Typical pedon of Bankard Variant very fine sandy loam, in an area of Craft-Bankard Variant very fine sandy loams, 400 feet north and 2,040 feet west of the southeast corner of sec. 16, T. 4 S., R. 20 E.

A—0 to 6 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; moderate thin and medium platy structure; soft, very friable; many medium and coarse roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—6 to 29 inches; very pale brown (10YR 7/3) and light gray (10YR 7/2) very fine sand stratified with thin layers of silt loam, loamy very fine sand, and loamy sand; pale brown (10YR 6/3) moist; single grain; soft, very friable; common fine and medium roots; strong effervescence; moderately alkaline; clear smooth boundary.

2C2—29 to 60 inches; multicolored gravelly sand; single grain; thin layer of loamy very fine sand at a depth of 42 inches; shale fragments mixed with the gravelly sand below a depth of 45 inches; strong effervescence; moderately alkaline.

Free carbonates commonly are at the surface, but some pedons are noncalcareous in the upper few inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It typically is very fine sandy loam but in some pedons is loamy fine sand, loamy sand, or very fine sand. The C horizon has hue of 10YR or 2.5Y. The content of gravel ranges from 25 to 60 percent in the 2C horizon.

Beckton Series

The Beckton series consists of deep, well drained soils formed in alluvium on uplands and terraces. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Beckton loam, in an area of Beckton-Arvada loams, 0 to 2 percent slopes, 450 feet south and 1,350 feet east of the northwest corner of sec. 14, T. 2 S., R. 22 E.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, friable; neutral; clear smooth boundary.

E—6 to 8 inches; light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak thin platy; slightly hard, friable; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; grayish brown (10YR 5/2) coatings on tops of columns; mildly alkaline; clear smooth boundary.

Bt2—14 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; clear wavy boundary.

Btkz—20 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common fine accumulations of carbonate and salts; strong effervescence; moderately alkaline; clear wavy boundary.

BC—30 to 47 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine accumulations of carbonate and salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C—47 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; few or common fine and medium faint olive brown (2.5Y 4/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate and salts; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 10 to 28 inches. The thickness of the mollic epipedon ranges from 7 to 16 inches.

The A horizon has hue of 10YR to 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam or fine sandy loam. It is slightly acid to mildly alkaline. The E horizon has hue of 10YR to 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2. The Bt horizon has hue of 10YR to 5Y, value of 3 to 6 (2 to 5 moist), and chroma of 1 to 3. It is mildly alkaline to strongly alkaline. The C horizon is moderately alkaline or strongly alkaline.

Beckton Variant

The Beckton Variant consists of moderately deep, well drained soils formed in alluvium over shale. These soils are on uplands. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Beckton Variant loam, in an area of Emigrant-Beckton Variant loams, 2 to 9 percent slopes, 2,200 feet east and 2,400 feet south of the northwest corner of sec. 20, T. 2 S., R. 22 E.

A—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; many fine and medium roots; slightly acid; clear smooth boundary.
E—6 to 8 inches; gray (10YR 6/1) loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure; slightly hard, friable; common fine and medium roots; neutral; abrupt smooth boundary.
Bt—8 to 12 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse columnar structure parting to strong fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; common fine and medium flat roots; mildly alkaline; clear wavy boundary.
Btk—12 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; few fine accumulations of carbonate; slight effervescence; moderately alkaline; clear wavy boundary.
Bk—16 to 20 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common fine accumulations of carbonate; strong effervescence; strongly alkaline; clear wavy boundary.
Bkz—20 to 32 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common fine and medium accumulations of salts; common fine accumulations of carbonate; strong effervescence; clear wavy boundary.
Cr—32 to 60 inches; pale yellow (2.5Y 7/4) shale, light yellowish brown (2.5Y 6/4) moist; massive; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 10 to 25 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam or fine sandy loam. It is slightly acid to mildly alkaline. The E horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2. The Bt horizon has hue of 10YR to 5Y, value of 3 to 6 (2 to 4 moist), and chroma of 1 to 3. It is clay or clay loam. It is neutral to moderately alkaline. The Cr horizon is interbedded shale, sandstone, and limestone.

Blackpipe Series

The Blackpipe series consists of moderately deep, well drained soils formed in siltstone residuum on uplands. Permeability is moderately slow. Slopes range from 3 to 9 percent.

Typical pedon of Blackpipe silt loam, in an area of Blackpipe-Wortman silt loams, 3 to 9 percent slopes, 750 feet south and 2,440 feet east of the northwest corner of sec. 10, T. 3 S., R. 21 E.

A—0 to 4 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, friable; many fine roots; neutral; clear smooth boundary.
Bt1—4 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable, sticky and plastic; common fine and medium roots; neutral; clear smooth boundary.
Bt2—12 to 17 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common fine and medium roots; slight effervescence; mildly alkaline; clear smooth boundary.
Bk1—17 to 25 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.
Bk2—25 to 37 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; 5 to 10 percent siltstone fragments; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.
Cr1—37 to 41 inches; light gray (10YR 7/2) siltstone, grayish brown (10YR 5/2) moist; massive; strong effervescence; mildly alkaline; clear smooth boundary.
Cr2—41 to 60 inches; white (10YR 8/2) siltstone, light gray (10YR 7/2) moist; massive; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 7 to 18 inches. The depth to free carbonates ranges from 12 to 25 inches. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 or 2. It is neutral or mildly alkaline.

Cactusflat Series

The Cactusflat series consists of deep, well drained soils formed in sodium-rich alluvium on uplands, fans, and terraces. Permeability is slow in the subsoil and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

Typical pedon of Cactusflat silty clay, in an area of Cactusflat-Weta complex, 1 to 6 percent slopes, 2,105 feet north and 810 feet west of the southeast corner of sec. 21, T. 2 S., R. 18 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak fine and medium granular; soft, friable, sticky and plastic; many fine and medium roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bw1—4 to 11 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bw2—11 to 19 inches; light brownish gray (10YR 6/2) silty clay, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; slight effervescence; mildly alkaline; gradual wavy boundary.

Bk—19 to 25 inches; pale brown (10YR 6/3) silty clay, brown (10YR 4/3) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

2Cz—25 to 31 inches; light gray (10YR 7/2) and very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable, sticky and slightly plastic; common fine and medium accumulations of salts and carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

2C—31 to 60 inches; light gray (10YR 7/2) clay loam, brown (10YR 5/3) moist; appears massive but has weak thin bedding planes; hard, friable, sticky and slightly plastic; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 6 inches. The thickness of the mollic epipedon ranges from 7 to 19 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay or clay. The Bw horizon has hue of 2.5Y or 10YR, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is clay, silty clay, or silty clay loam. It is mildly alkaline or moderately alkaline. The sodium adsorption ratio ranges from 10 to 25. The C horizon has hue of 2.5Y, 7.5YR, or 10YR. It is silty clay loam, clay loam, or silt loam that has thin layers ranging from very fine sandy loam to clay. Mudstone or siltstone is at a depth of 40 to 60 inches in some pedons.

Cedarpass Series

The Cedarpass series consists of deep, well drained soils formed in sodium-rich, silty material on uplands. Permeability is moderate. Slopes range from 0 to 6 percent.

Typical pedon of Cedarpass silt loam, 0 to 3 percent slopes, 463 feet north and 1,035 feet west of the southeast corner of sec. 4, T. 4 S., R. 18 E.

A—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; many fine and medium roots; slightly acid; clear wavy boundary.

Bw1—3 to 7 inches; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist, dark grayish brown (10YR 4/2) crushed; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; slight effervescence; neutral; clear wavy boundary.

Bw2—7 to 17 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; common fine and medium roots; strong effervescence; mildly alkaline; gradual wavy boundary.

C1—17 to 35 inches; very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) moist; massive; hard, friable, few fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

C2—35 to 45 inches; very pale brown (10YR 8/3) stratified silt loam, very fine sandy loam, and silty clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.

C3—45 to 51 inches; light brownish gray (10YR 6/2) and very pale brown (10YR 8/3) loam, very dark grayish brown (10YR 3/2) and pale brown (10YR 6/3) moist; appears massive but has thin bedding planes; hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.

C4—51 to 60 inches; very pale brown (10YR 8/3) stratified silt loam and silty clay loam, pale brown (10YR 6/3) moist; massive; hard, friable; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 8 inches. The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It dominantly is silt loam but in some pedons is silty clay loam or very fine sandy loam. The Bw horizon has hue of 7.5YR or 10YR, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 4. It is silty clay loam, silt loam, or very fine sandy loam. It is neutral to moderately alkaline. The C horizon has hue of 7.5YR or 10YR. It is stratified silty clay loam, silt loam, loam, very fine sandy loam, loamy fine sand, or fine sand. The sodium adsorption ratio ranges from 10 to 30.

Colby Series

The Colby series consists of deep, well drained soils formed in calcareous, silty material on uplands. Permeability is moderate. Slopes range from 6 to 15 percent.

Typical pedon of Colby silt loam, in an area of Norka-Colby silt loams, 6 to 15 percent slopes, 2,500 feet south and 1,320 feet west of the northeast corner of sec. 7, T. 3 S., R. 19 E.

A—0 to 6 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; many fine and medium roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bw—6 to 9 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist, dark grayish brown (10YR 4/2) crushed; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; many fine and medium roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bk—9 to 22 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky; hard, friable; many fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1—22 to 48 inches; light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; massive; hard, friable; many fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—48 to 60 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable; strong effervescence; moderately alkaline.

Free carbonates are at or near the surface. The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It is silt loam, loam, silty clay loam, or very fine sandy loam. It is mildly alkaline or moderately alkaline. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silt loam or loam in the upper part and silty clay loam or silt loam in the lower part. It is mildly alkaline to strongly alkaline.

Colby silt loam, 6 to 15 percent slopes, is a taxadjunct to the Colby series because it has a high sodium adsorption ratio.

Conata Series

The Conata series consists of shallow, well drained soils formed in clayey shale residuum on uplands. Permeability is very slow. Slopes range from 6 to 15 percent.

Typical pedon of Conata clay, in an area of Larvie-Conata clays, 6 to 15 percent slopes, 1,090 feet north and 2,730 feet east of the southwest corner of sec. 19, T. 2 S., R. 19 E.

A1—0 to 2 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; many fine and medium roots; neutral; clear smooth boundary.

A2—2 to 6 inches; brown (10YR 4/3) clay, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, sticky and plastic; many fine and medium roots; slight effervescence; neutral; clear smooth boundary.

Bw—6 to 13 inches; light yellowish brown (10YR 6/4) and pinkish gray (5YR 6/2) clay, dark yellowish brown (10YR 4/4) and reddish gray (5YR 5/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; common fine and medium roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk—13 to 18 inches; pale red (10R 6/2), brownish yellow (10YR 6/6), and light gray (5Y 7/2) clay, weak red (10R 4/2), dark yellowish brown (10YR 4/6), and olive gray (5Y 5/2) moist; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; very hard, very firm, sticky and plastic; few fine and medium roots; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—18 to 60 inches; pale red (10R 6/2), brownish yellow (10YR 6/6), and light gray (5Y 7/2) shale, weak red (10R 5/2), dark yellowish brown (10YR 4/6), and olive gray (5Y 5/2) moist; massive; few fine roots in the upper part; strong effervescence; mildly alkaline.

The depth to shale ranges from 10 to 20 inches. Free carbonates are at or near the surface.

The A horizon has hue of 10R to 5Y, value of 3 to 5 (2 to 4 moist), and chroma of 2 to 4. It is neutral or mildly alkaline. The Bw horizon has hue of 10R to 5Y, value of 3 to 6 (dry or moist), and chroma of 2 to 6. It is mildly alkaline or moderately alkaline. The Cr horizon has hue of 10R to 5Y. It is mildly alkaline or moderately alkaline.

Craft Series

The Craft series consists of deep, well drained soils formed in calcareous alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Craft very fine sandy loam, in an area of Craft-Bankard Variant very fine sandy loams, 620 feet south and 1,825 feet west of the northeast corner of sec. 21, T. 4 S., R. 20 E.

A—0 to 6 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak fine granular structure; soft, very friable; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 42 inches; light gray (10YR 7/2) very fine sandy loam stratified with thin layers of loam and loamy very fine sand; light brownish gray (10YR 6/2) moist; massive; soft, very friable; common fine and medium roots in the upper part; strong effervescence; moderately alkaline; clear smooth boundary.

C2—42 to 60 inches; light gray (10YR 7/2) fine sand that has a thin layer of very fine sandy loam at a depth of 58 inches; light brownish gray (10YR 6/2) moist; single grain; loose; strong effervescence; moderately alkaline.

Free carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile. The A horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 or 3. It dominantly is very fine sandy loam but in some pedons is loamy very fine sand, loam, or silt loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 1 to 3. It is very fine sandy loam that has thin layers of fine sand or gravelly sand below a depth of 40 inches. Buried horizons are below a depth of 24 inches in some pedons.

Dawes Series

The Dawes series consists of deep, moderately well drained soils formed in silty material on uplands. Permeability is slow in the subsoil and moderate in the underlying material. Slopes are 2 to 3 percent.

These soils are taxadjuncts to the Dawes series because they have montmorillonitic mineralogy and a natric horizon.

Typical pedon of Dawes silt loam, in an area of Savo-Dawes silt loams, 2 to 6 percent slopes, 1,510 feet south and 2,265 feet west of the northeast corner of sec. 12, T. 3 S., R. 18 E.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

E—7 to 10 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure parting to weak thin platy; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bt—10 to 17 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium columnar structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

Bk1—17 to 26 inches; light brownish gray (10YR 6/2) silty clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Bk2—26 to 41 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C—41 to 60 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to free carbonates ranges from 14 to 21 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It dominantly is silt loam but in some pedons is loam. The E horizon has value of 6 or 7 (4 to 6 moist) and chroma of 1 or 2. Reaction is slightly acid or neutral in the A and E horizons. The Bt horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. It is silty clay or silty clay loam. The content of clay in this horizon ranges from 35 to 50 percent. The C horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 or 3. It is silt loam, silty clay loam, or loam. It is moderately alkaline or strongly alkaline.

Denby Series

The Denby series consists of deep, well drained soils formed in sodium-rich alluvium on fans and uplands. Permeability is slow. Slopes range from 0 to 4 percent.

Typical pedon of Denby silty clay, in an area of Cedarpass-Denby complex, 0 to 4 percent slopes, 800 feet north and 200 feet west of the southeast corner of sec. 15, T. 3 S., R. 21 E.

A—0 to 5 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, friable, sticky and plastic; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bw1—5 to 11 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bw2—11 to 21 inches; light brownish gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak medium and coarse prismatic structure parting to weak fine subangular blocky; hard, firm, sticky and plastic; few fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

BC—21 to 27 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable, sticky and plastic; few fine roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C—27 to 32 inches; very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few fine roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

Ab—32 to 36 inches; gray (10YR 5/1) and very pale brown (10YR 8/3) silty clay, dark gray (10YR 4/1) and pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; few fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

2C—36 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; thin lenses of very fine sandy loam and loam; strong effervescence; moderately alkaline.

Free carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is silty clay 2 to 5 inches thick. The Bw horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 to 4. It is silty clay, clay, or silty clay loam. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 to 4. It is stratified silty clay to very fine sandy loam.

Emigrant Series

The Emigrant series consists of moderately deep, well drained soils formed in loamy material over shale. These soils are on uplands. Permeability is moderately slow. Slopes range from 0 to 15 percent.

Typical pedon of Emigrant loam, 1 to 6 percent slopes, 1,640 feet south and 650 feet west of the northeast corner of sec. 20, T. 1 S., R. 22 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; neutral; clear smooth boundary.

Bt1—3 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common fine and medium roots; neutral; clear smooth boundary.

Bt2—6 to 16 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; common fine and medium roots; neutral; gradual wavy boundary.

Bk1—16 to 20 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; common fine and medium roots; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk2—20 to 30 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few fine roots; many fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—30 to 60 inches; light gray (2.5Y 7/2) shale, light olive gray (5Y 6/2) moist; light brown (7.5YR 6/4) stains; massive; few fine roots in the upper part; strong effervescence; moderately alkaline.

The depth to shale ranges from 20 to 40 inches. The depth to free carbonates ranges from 10 to 23 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is slightly acid to mildly alkaline. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 to 4. It is neutral to moderately alkaline. The Cr horizon is

calcareous, interbedded shale, sandstone, and limestone.

Haverson Series

The Haverson series consists of deep, well drained soils formed in calcareous alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Haverson loam, 1,610 feet west and 2,030 feet north of the southeast corner of sec. 18, T. 4 S., R. 20 E.

Ap—0 to 7 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure parting to weak fine granular; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—7 to 14 inches; light gray (10YR 7/2) stratified loam, light brownish gray (10YR 6/2) moist; appears massive but has weak bedding planes; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C2—14 to 24 inches; light brownish gray (10YR 6/2) and light gray (10YR 7/2) stratified clay loam and silt loam, grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) moist; appears massive but has weak bedding planes; slightly hard, friable, slightly sticky and plastic; strong effervescence; moderately alkaline; clear smooth boundary.

C3—24 to 35 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; appears massive but has weak bedding planes; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C4—35 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; appears single grain but has weak bedding planes; loose; strong effervescence; moderately alkaline.

Free carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile. The A horizon has hue of 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It dominantly is loam but in some pedons is silt loam. The C horizon has hue of 2.5Y to 7.5YR.

Hilmoe Series

The Hilmoe series consists of deep, moderately well drained soils formed in alluvium on the flood plains along the White River. Permeability is slow in the upper part of the profile and moderate in the underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Hilmoe silty clay, 780 feet north and 300 feet west of the southeast corner of sec. 24, T. 2 S., R. 25 E.

Ap—0 to 5 inches; gray (10YR 5/1) silty clay, very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; mildly alkaline; slight effervescence; clear smooth boundary.

C—5 to 17 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; very hard, firm, sticky and plastic; slight effervescence; mildly alkaline; gradual wavy boundary.

Ck—17 to 25 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) clay, very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky but has thin bedding planes; very hard, firm, sticky and plastic; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

2C—25 to 60 inches; light gray (10YR 7/2) stratified fine sandy loam, silt loam, and fine sand, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; strong effervescence; mildly alkaline.

Free carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay but in some pedons is clay or silty clay loam. The C horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 1 to 3. It is clay, silty clay loam, or silty clay. The 2C horizon has hue of 5Y, 2.5Y, or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is stratified clay to fine sand.

Hisle Series

The Hisle series consists of moderately deep, well drained soils formed in clayey shale residuum on uplands. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Hisle silt loam, in an area of Hisle-Slickspots complex, 0 to 9 percent slopes, 1,850 feet north and 60 feet east of the southwest corner of sec. 20, T. 1 S., R. 18 E.

E—0 to 1 inch; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak fine granular; soft, very friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—1 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; grayish brown (10YR 5/2) coatings on tops of columns; moderate

medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, firm, sticky and plastic; common fine flat roots; mildly alkaline; clear wavy boundary.

Bt2—3 to 7 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, firm, sticky and plastic; common fine flat roots; slight effervescence; mildly alkaline; gradual wavy boundary.

Bkz—7 to 15 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine accumulations of salts and carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1—15 to 19 inches; pale olive (5Y 6/3) clay, olive (5Y 5/3) moist; massive; hard, firm, sticky and plastic; few very fine and fine roots; few fine accumulations of salts and carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—19 to 26 inches; pale olive (5Y 6/3) shaly clay, olive (5Y 5/3) moist; massive; hard, friable, sticky and plastic; common shale fragments; few fine accumulations of salts and carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—26 to 60 inches; light gray (2.5Y 7/2 and N 7/0) shale, gray (N 5/0) and light brownish gray (2.5Y 6/2) moist; massive; common fine and medium accumulations of salts in the upper part; slight effervescence; mildly alkaline.

The depth to shale ranges from 20 to 40 inches. The depth to free carbonates is 2 to 6 inches.

The E horizon has hue of 10YR or 2.5Y, value of 5 to 8 (3 to 5 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is loam. It is 1 to 3 inches thick. It is slightly acid to mildly alkaline. The B horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It is mildly alkaline to strongly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 8 (3 to 5 moist), and chroma of 1 to 3. The Cr horizon ranges from slightly acid to moderately alkaline.

The Hisle soil in the Larvie-Hisle complex, 2 to 9 percent slopes, is a taxadjunct because it has a redder hue than is definitive for the Hisle series.

Hurley Series

The Hurley series consists of deep, moderately well drained soils formed in clayey material on uplands. Permeability is very slow. Slopes range from 0 to 6 percent.

These soils are taxadjuncts because they are deeper to shale than is definitive for the Hurley series.

Typical pedon of Hurley silt loam, in an area of Promise-Hurley complex, 0 to 3 percent slopes, 460 feet north and 1,005 feet east of the southwest corner of sec. 28, T. 2 S., R. 22 E.

E—0 to 2 inches; light gray (10YR 6/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak fine granular; soft, friable; common fine and medium roots; neutral; abrupt smooth boundary.

Bt1—2 to 7 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, firm, sticky and plastic; common fine and medium roots; moderately alkaline; clear wavy boundary.

Bt2—7 to 15 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium prismatic structure parting to weak fine and medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; strong effervescence; moderately alkaline; clear wavy boundary.

Bkz1—15 to 24 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; few or common fine and medium accumulations of salts; few fine accumulations of salts and carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Bkz2—24 to 33 inches; gray (10YR 5/1) and light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) and dark gray (10YR 4/1) moist; weak fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; common fine and medium accumulations of salts; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—33 to 45 inches; light gray (10YR 6/1) and light brownish gray (10YR 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; few fine and medium accumulations of salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—45 to 60 inches; gray (10YR 5/1) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of salts; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 4 to 12 inches. The E horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is slightly acid or neutral. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y. It

is mildly alkaline to strongly alkaline. A buried horizon is in some pedons.

Interior Series

The Interior series consists of deep, well drained soils formed in sodium-rich, loamy and silty alluvium on fans and flood plains. Permeability is moderately slow. Slopes range from 0 to 3 percent.

Typical pedon of Interior loam, 245 feet north and 710 feet west of the southeast corner of sec. 9, T. 4 S., R. 18 E.

A—0 to 4 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak very thin platy structure; soft, very friable; common fine to coarse roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—4 to 13 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; appears massive but has distinct bedding planes; soft, friable; common fine and medium roots; strong effervescence; moderately alkaline; clear smooth boundary.

C2—13 to 22 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; appears massive but has distinct bedding planes; hard, friable; common fine and medium roots; strong effervescence; moderately alkaline; clear smooth boundary.

C3—22 to 35 inches; light gray (10YR 7/2) and white (10YR 8/2) stratified silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable; common fine and medium roots; strong effervescence; moderately alkaline; gradual wavy boundary.

C4—35 to 60 inches; light gray (10YR 7/2) and white (10YR 8/2) stratified silt loam and silty clay loam, light brownish gray (10YR 6/2) and brown (10YR 5/3) moist; massive; hard, friable; few fine roots in the upper part; strong effervescence; moderately alkaline.

Free carbonates are at the surface. The sodium adsorption ratio ranges from 10 to 25 throughout the profile.

The A horizon has hue of 5YR to 10YR, value of 5 to 8 (3 to 7 moist), and chroma of 1 to 3. It dominantly is loam but in some pedons is silty clay loam, fine sandy loam, loamy fine sand, silty clay, or silt loam. It is mildly alkaline to strongly alkaline. The C horizon has hue of 5YR to 10YR. It is stratified fine sand to clay. It is moderately alkaline to very strongly alkaline.

Kolls Series

The Kolls series consists of deep, poorly drained soils formed in clayey alluvium in depressions on uplands. When dry, these soils are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes are 0 to 1 percent.

Typical pedon of Kolls clay, 700 feet south and 800 feet west of the northeast corner of sec. 23, T. 2 S., R. 19 E.

A—0 to 3 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine granular structure; hard, friable, sticky and plastic; many fine and medium roots; slight effervescence; mildly alkaline; clear wavy boundary.

Bw—3 to 16 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; common fine and medium roots; few intersecting slickensides; strong effervescence; mildly alkaline; gradual wavy boundary.

Bkg—16 to 27 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; extremely hard, very firm, sticky and plastic; common fine and medium roots; pressure faces evident; few intersecting slickensides; common fine accumulations of carbonates; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkyg—27 to 42 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; few intersecting slickensides; few fine accumulations of carbonate; common fine and medium accumulations of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—42 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

The mollic epipedon typically is less than 20 inches thick but extends to a depth of 30 inches in some pedons. Carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 (2 or 3 moist) and chroma of 0 or 1. It dominantly is clay but in some pedons is silty clay. The Bw horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 or 5 (2 to 4 moist) and chroma of 0 or 1. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3.

Kyle Series

The Kyle series consists of deep, well drained soils formed in clayey sediments weathered from shale.

These soils are on foot slopes and fans in the uplands. When dry, they are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is evident. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Kyle clay, 0 to 3 percent slopes, 1,520 feet north and 1,980 feet west of the southeast corner of sec. 22, T. 2 S., R. 25 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium granular structure; hard, firm, sticky and plastic; many fine roots; neutral; clear smooth boundary.

Bw1—4 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; common intersecting slickensides; strong effervescence; mildly alkaline; gradual smooth boundary.

Bw2—8 to 17 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to moderate fine and medium blocky and subangular blocky; extremely hard, very firm, sticky and plastic; common fine roots; common intersecting slickensides; strong effervescence; moderately alkaline; gradual smooth boundary.

BC—17 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; common intersecting slickensides; strong effervescence; moderately alkaline; gradual wavy boundary.

Cy—24 to 43 inches; olive (5Y 5/3) clay, dark grayish brown (2.5Y 4/2) moist; weak fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots in the upper part; common intersecting slickensides; common fine and medium accumulations of gypsum; strong effervescence; mildly alkaline; gradual wavy boundary.

C—43 to 60 inches; olive (5Y 5/3) clay, olive (5Y 4/3) moist; massive; very hard, firm, sticky and plastic; few fine and medium accumulations of gypsum; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 0 to 6 inches. The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It dominantly is clay but in some pedons is silty clay. It is neutral or mildly alkaline. The B and C horizons have hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. They are mildly alkaline or moderately alkaline.

Larvie Series

The Larvie series consists of moderately deep, well drained soils formed in shale residuum on uplands. When dry, these soils are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is prominent. Permeability is very slow. Slopes range from 2 to 15 percent.

Typical pedon of Larvie clay, in an area of Larvie-Conata clays, 6 to 15 percent slopes, 700 feet north and 310 feet east of the southwest corner of sec. 21, T. 1 S., R. 18 E.

A—0 to 5 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 4/2) moist; weak fine granular structure; very hard, friable, sticky and plastic; common fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bw—5 to 12 inches; weak red (2.5YR 5/2) clay, weak red (2.5YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; few fine roots; few intersecting slickensides; slight effervescence; mildly alkaline; clear smooth boundary.

Bk—12 to 18 inches; weak red (10R 5/2) clay, weak red (10R 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; few fine roots; few intersecting slickensides; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bky—18 to 26 inches; weak red (10R 5/2) clay, weak red (10R 4/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; common shale fragments; few intersecting slickensides; common fine and medium accumulations of carbonate; few fine accumulations of gypsum; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—26 to 60 inches; weak red (10R 5/2) shale, weak red (10R 4/2) moist; massive; common fine accumulations of gypsum; strong effervescence; mildly alkaline.

The depth to bedrock ranges from 20 to 40 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile. The A horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. The B horizon has hue of 10YR to 10R, value of 4 to 6 (4 or 5 moist), and chroma of 1 to 3.

Lohmiller Series

The Lohmiller series consists of deep, well drained soils formed in alluvium on flood plains. Permeability is slow. Slopes range from 0 to 2 percent.

Typical pedon of Lohmiller silty clay, 1,650 feet south and 600 feet west of the northeast corner of sec. 18, T. 4 S., R. 20 E.

A—0 to 6 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; moderate fine granular structure; very hard, friable, sticky and plastic; common fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—6 to 34 inches; pale brown (10YR 6/3) silty clay stratified with thin layers of silty clay loam; brown (10YR 5/3) moist; massive; extremely hard, firm, sticky and plastic; common fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C2—34 to 46 inches; light gray (10YR 7/2) stratified very fine sandy loam and silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

C3—46 to 58 inches; pale brown (10YR 6/3) stratified silty clay and silty clay loam, brown (10YR 5/3) moist; massive; extremely hard, firm, sticky and plastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

C4—58 to 60 inches; light gray (10YR 7/2) stratified very fine sandy loam, grayish brown (10YR 5/2) moist; massive; hard, friable; strong effervescence; moderately alkaline.

Free carbonates are at or near the surface. The clay content in the control section ranges from 35 to 50 percent.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), chroma of 2 or 3. It dominantly is silty clay but in some pedons is silty clay loam. It is neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is stratified silty clay, silty clay loam, silt loam, and very fine sandy loam. It is mildly alkaline or moderately alkaline.

Metre Series

The Metre series consists of moderately deep, well drained soils formed in clayey shale residuum on uplands. When dry, these soils are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is prominent. Permeability is very slow. Slopes range from 0 to 6 percent.

Typical pedon of Metre clay, in an area of Metre-Larvie clays, 2 to 6 percent slopes, 650 feet south and 200 feet west of the northeast corner of sec. 29, T. 1 S., R. 18 E.

A—0 to 4 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine granular structure; soft, friable, sticky and plastic; common fine and medium roots; mildly alkaline; clear smooth boundary.

Bw1—4 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; very hard, very firm, sticky and plastic; common fine and medium roots; few intersecting slickensides; strong effervescence; mildly alkaline; clear smooth boundary.

Bw2—10 to 19 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium blocky; extremely hard, very firm, sticky and plastic; common fine and medium roots; few intersecting slickensides; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk—19 to 25 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few intersecting slickensides; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—25 to 37 inches; brown (7.5YR 5/2) clay, brown (7.5YR 5/2) moist; massive; very hard, very firm, sticky and plastic; few fine roots; few intersecting slickensides; few fine accumulations of carbonate and gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—37 to 60 inches; light gray (10YR 7/1), pale red (10R 6/2), and weak red (10R 4/2) shale; few fine accumulations of carbonate; few fine and medium accumulations of salts; strong effervescence; moderately alkaline.

The depth to shale ranges from 20 to 40 inches. The depth to free carbonates is 0 to 6 inches. The thickness of the mollic epipedon ranges from 8 to 16 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 3 to 5 (2 or 3 moist) and chroma of 0 to 2. The Bw horizon has hue of 2.5Y or 10YR or is neutral in hue. It has value of 4 or 5 (3 or 4 moist) and chroma of 0 to 2. The content of clay in this horizon ranges from 60 to 70 percent. The C and Cr horizons are multicolored. The Cr horizon is soft clayey shale that is weathered to varying degrees.

Midway Series

The Midway series consists of shallow, well drained soils formed in shale residuum on uplands. Permeability is slow. Slopes range from 6 to 40 percent.

Typical pedon on Midway silty clay loam, in an area of Razor-Midway silty clay loams, 6 to 15 percent slopes, 600 feet north and 1,000 feet west of the southeast corner of sec. 12, T. 2 S., R. 21 E.

A—0 to 6 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

C—6 to 14 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; weak medium and coarse prismatic structure parting to weak medium and coarse blocky; hard, firm, sticky and plastic; common fine and medium roots; common shale fragments; strong effervescence; mildly alkaline; clear smooth boundary.

Cr—14 to 60 inches; light gray (2.5Y 7/2) sandy, silty, and clayey shale, light brownish gray (2.5Y 6/2) moist; common fine roots in the upper part; strong effervescence; moderately alkaline.

The depth to shale ranges from 6 to 20 inches. Free carbonates are at or near the surface. The clay content in the control section averages as low as 35 percent in some pedons and as high as 45 percent in others.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y. It dominantly is silty clay but in some pedons is clay loam, silty clay loam, or clay.

Nihill Series

The Nihill series consists of deep, excessively drained soils formed in gravelly alluvium on uplands. Permeability is moderately rapid. Slopes range from 6 to 15 percent.

Typical pedon of Nihill gravelly loam, in an area of Nunn-Nihill complex, 6 to 15 percent slopes, 1,320 feet north and 2,577 feet east of the southwest corner of sec. 26, T. 1 S., R. 18 E.

A—0 to 9 inches; grayish brown (2.5Y 5/2) gravelly loam, very dark grayish brown (2.5Y 3/2) moist, dark grayish brown (2.5Y 4/2) crushed; weak fine granular structure; slightly hard, friable; common fine roots; strong effervescence; mildly alkaline; gradual wavy boundary.

C—9 to 60 inches; pale yellow (2.5Y 7/4) very gravelly loam, light olive brown (2.5Y 5/4) moist, massive; loose, friable; few fine roots in the upper part; carbonates on the underside of gravel in the upper part; strong effervescence; mildly alkaline.

Free carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It dominantly is gravelly loam but in some pedons is gravelly sandy loam or gravelly clay loam. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 to 4. The content of gravel in this horizon ranges from 35 to 60 percent.

Norka Series

The Norka series consists of deep, well drained soils formed in silty material on uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Typical pedon of Norka silt loam, 0 to 3 percent slopes, 200 feet north and 1,260 feet east of the southwest corner of sec. 21, T. 2 S., R. 18 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; many medium roots; neutral; clear wavy boundary.

Bt—5 to 11 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; very dark brown (10YR 2/2) moist coatings on faces of peds; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; neutral; clear wavy boundary.

Bk—11 to 15 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak and moderate coarse subangular blocky; slightly hard, very friable; common fine roots; few or common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—15 to 60 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; massive; hard, very friable; common fine roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 5 to 15 inches. The depth to the base of the argillic horizon ranges from 7 to 15 inches. The mollic epipedon is 7 to 11 inches thick.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is neutral or mildly alkaline. The Bt horizon also is neutral or mildly alkaline. It has hue of 7.5YR to 2.5Y, value of 5 to 7 (3 to 6 moist), and chroma of 1 to 4. The C horizon has hue of 7.5YR to 5Y. It is mildly alkaline or moderately alkaline.

Norrest Series

The Norrest series consists of moderately deep, well drained soils formed in siltstone residuum on uplands. Permeability is moderately slow. Slopes range from 2 to 9 percent.

Typical pedon of Norrest silt loam, in an area of Norrest-Wanblee complex, 2 to 9 percent slopes, 790 feet east and 300 feet south of the northwest corner of sec. 9, T. 4 S., R. 18 E.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, friable; many fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bt1—4 to 8 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine and medium blocky; hard, firm, slightly sticky and slightly plastic; common fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bt2—8 to 22 inches; light gray (10YR 7/2) silty clay, brown (10YR 5/3) moist; weak medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; common fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkz—22 to 28 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few fine roots; few fine siltstone fragments; few or common fine accumulations of salts; common fine and medium accumulations of carbonate; moderately alkaline; clear smooth boundary.

Cr—28 to 60 inches; light gray (10YR 7/2) siltstone, light brownish gray (10YR 6/2) moist; massive; strong effervescence; moderately alkaline.

The depth to bedrock ranges from 20 to 40 inches. The soils contain free carbonates throughout. They are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 4 to 6 (2 to 5 moist) and chroma of 1 to 3. It dominantly is silt loam but in some pedons is silty clay loam or clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 1 to 3. It is clay loam, silty clay, silty clay loam, or clay. The Cr horizon is fractured siltstone or silty shale.

Nunn Series

The Nunn series consists of deep, well drained soils formed in alluvium on high terraces. Permeability is slow. Slopes range from 0 to 15 percent.

Typical pedon of Nunn loam, 0 to 3 percent slopes, 180 feet north and 315 feet west of the southeast corner of sec. 5, T. 2 S., R. 18 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, friable; many fine roots; neutral; clear smooth boundary.

BA—5 to 11 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

Bt—11 to 26 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, firm, sticky and plastic; common fine roots; shiny films on faces of peds; neutral; gradual wavy boundary.

Btk—26 to 31 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common fine roots; patchy films on faces of peds; few or common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk—31 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many or common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; few or common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 19 inches. The depth to free carbonates ranges from 10 to 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It dominantly is loam but in some pedons is clay loam or fine sandy loam. It is slightly acid to mildly alkaline. The Bt horizon has value of 5Y to 7.5YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. It ranges from slightly acid to moderately alkaline. It is clay or clay loam. The content of clay in this horizon ranges from 35 to 50 percent.

Orella Series

The Orella series consists of shallow, well drained soils formed in shale residuum on uplands. Permeability is very slow. Slopes range from 3 to 25 percent.

Typical pedon of Orella clay loam, in an area of Orella-Rock outcrop complex, 3 to 45 percent slopes, 1,050 feet north and 2,437 feet west of the southeast corner of sec. 18, T. 3 S., R. 18 E.

A—0 to 3 inches; light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable, slightly plastic; 1 to 10 percent rock fragments 1 to 3 inches in diameter; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

AC—3 to 9 inches; light gray (10YR 7/2) clay, grayish brown (10YR 5/2) moist; moderate fine and medium blocky structure; extremely hard, very firm, sticky and plastic; common fine and medium flat roots; strong effervescence; moderately alkaline; gradual wavy boundary.

C—9 to 14 inches; light gray (10YR 7/2) clay, grayish brown (10YR 5/2) moist; massive; extremely hard, very firm, sticky and plastic; common fragments of shale; common fine and medium flat roots; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—14 to 60 inches; light gray (10YR 7/2) and very pale brown (10YR 7/3) shale, light brownish gray (10YR 6/2) and pale brown (10YR 6/3) moist; few fine roots in the upper part; slight effervescence; moderately alkaline.

The depth to shale ranges from 10 to 20 inches. Free carbonates are at or near the surface. Reaction is mildly alkaline to strongly alkaline throughout the profile.

The A horizon has hue of 7.5YR to 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 to 4. It dominantly is clay loam but in some pedons is silty clay, clay, or silty clay loam. The C horizon has hue of 7.5YR to 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 or 3. The sodium adsorption ratio ranges from 10 to 25.

Pierre Series

The Pierre series consists of moderately deep, well drained soils formed in shale residuum on uplands. When dry, these soils are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is prominent in most areas. Permeability is very slow. Slopes range from 2 to 25 percent.

Typical pedon of Pierre clay, in an area of Pierre-Samsil clays, 6 to 15 percent slopes, 300 feet south and 740 feet east of the northwest corner of sec. 36, T. 1 S., R. 25 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; soft, friable, sticky and plastic; common fine roots; slight effervescence; neutral; clear smooth boundary.

Bw1—4 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; common very fine and fine roots; common intersecting slickensides; strong effervescence; mildly alkaline; clear smooth boundary.

Bw2—13 to 26 inches; pale olive (5Y 6/3) clay, olive (5Y 4/3) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, very firm, sticky and plastic; common fine roots; common intersecting slickensides; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk—26 to 34 inches; pale olive (5Y 6/3) clay, olive (5Y 4/3) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few intersecting slickensides; few shale fragments; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—34 to 37 inches; pale olive (5Y 6/3) shaly clay, olive (5Y 4/3) moist; massive; very hard, very firm, sticky and plastic; few fine roots; common shale fragments; few fine accumulations of gypsum; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—37 to 60 inches; pale yellow (5Y 7/3) and gray (5Y 5/1) shale, olive (5Y 5/3) and dark gray (5Y 4/1) moist; few fine roots in the upper part; common fine accumulations of gypsum in the upper part; slight effervescence; mildly alkaline.

Free carbonates are at or near the surface. The depth to shale ranges from 20 to 40 inches.

The A horizon has hue of 10YR to 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It dominantly is clay but in some pedons is silty clay. It is slightly acid to mildly alkaline. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3. It is mildly alkaline or moderately alkaline. The clay content in this horizon ranges from 60 to 70 percent.

Promise Series

The Promise series consists of deep, well drained soils formed in clayey material on uplands. When dry, these soils are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is evident in most areas. Permeability is very slow. Slopes range from 0 to 9 percent.

Typical pedon of Promise clay, in an area of Promise-Hurley complex, 3 to 6 percent slopes, 640 feet south

and 1,550 feet west of the northeast corner of sec. 21, T. 2 S., R. 23 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

Bw1—5 to 15 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; few intersecting slickensides; strong effervescence; mildly alkaline; gradual wavy boundary.

Bw2—15 to 26 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; common intersecting slickensides; pressure faces evident; strong effervescence; moderately alkaline; gradual wavy boundary.

By—26 to 38 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm, sticky and plastic; patchy films on faces of peds; few or common fine accumulations of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

C—38 to 60 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; few fine and medium accumulations of gypsum; strong effervescence; moderately alkaline.

The depth to free carbonates is 0 to 8 inches. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay. It is slightly acid to mildly alkaline. The Bw horizon has value of 4 to 6 (2 to 4 moist) and chroma of 1 to 3. It is mildly alkaline or moderately alkaline. The content of clay in this horizon ranges from 60 to 70 percent. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is mildly alkaline to strongly alkaline.

Razor Series

The Razor series consists of moderately deep, well drained soils formed in clayey shale residuum on uplands. Permeability is slow. Slopes range from 2 to 15 percent.

Typical pedon of Razor silty clay loam, in an area of Razor-Midway silty clay loams, 6 to 15 percent slopes, 675 feet north and 590 feet west of the southeast corner of sec. 12, T. 2 S., R. 21 E.

A—0 to 3 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; many fine and medium roots; neutral; clear smooth boundary.

Bw1—3 to 8 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; very dark grayish brown (10YR 3/2) coatings on vertical faces of peds; moderate medium and coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable, sticky and plastic; many fine and medium roots; mildly alkaline; clear smooth boundary.

Bw2—8 to 16 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium and coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable, sticky and plastic; common fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

Bk—16 to 33 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; very hard, firm, sticky and plastic; common fine roots; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—33 to 60 inches; light gray (2.5Y 7/2) shale, light brownish gray (2.5Y 6/2) moist; brownish yellow (10YR 6/8) moist stains on horizontal bedding planes; strong effervescence; moderately alkaline.

The depth to shale ranges from 20 to 40 inches. The A horizon has hue of 10YR or 2.5Y and value of 5 or 6 (3 to 5 moist). It dominantly is silty clay loam but in some pedons is silty clay. It is neutral to moderately alkaline. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6 (dry or moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline. It is silty clay loam or silty clay. The content of clay in this horizon ranges from 35 to 55 percent.

Samsil Series

The Samsil series consists of shallow, well drained soils formed in shale residuum on uplands. Permeability is slow. Slopes range from 6 to 45 percent.

Typical pedon of Samsil clay, in an area of Samsil-Pierre clays, 15 to 25 percent slopes, 1,475 feet south and 1,200 feet west of the northeast corner of sec. 22, T. 2 S., R. 25 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; hard, friable, sticky and plastic; common fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Cy—3 to 11 inches; light brownish gray (2.5Y 6/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable, sticky and plastic; common fine roots; common fine and medium accumulations of gypsum; slight effervescence; mildly alkaline; clear smooth boundary.
Cr—11 to 60 inches; light olive gray (5Y 6/2) shale, olive gray (5Y 5/2) moist; common fine and medium accumulations of gypsum in the upper part; slight effervescence; neutral.

The depth to shale ranges from 6 to 20 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile. Free carbonates are at or near the surface. The A and C horizons have hue of 10YR to 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. The Cr horizon ranges from medium acid to moderately alkaline.

Savo Series

The Savo series consists of deep, well drained soils formed in silty material on uplands. Permeability is moderately slow. Slopes range from 2 to 6 percent.

Typical pedon of Savo silt loam, in an area of Savo-Dawes silt loams, 2 to 6 percent slopes, 250 feet north and 1,850 feet west of the southeast corner of sec. 7, T. 3 S., R. 19 E.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.
Bt1—5 to 12 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.
Bt2—12 to 22 inches; brown (10YR 5/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, sticky and plastic; common fine and medium roots; slight effervescence; neutral; gradual wavy boundary.
Bk1—22 to 32 inches; light gray (7/2) silty clay loam, brown (10YR 5/3) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable, sticky and plastic; common fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.
Bk2—32 to 42 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and plastic; many fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.
C—42 to 60 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates is 12 to 20 inches. The mollic epipedon is 7 to 15 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 to 3. It is slightly acid to mildly alkaline. It is silty clay loam, clay loam, silty clay, or clay. The content of clay in this horizon ranges from 35 to 50 percent. The C horizon has hue of 2.5Y or 10YR, value of 5 to 7 (5 or 6 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Valent Series

The Valent series consists of deep, excessively drained soils formed in eolian sand on uplands. Permeability is rapid. Slopes range from 3 to 9 percent.

Typical pedon of Valent loamy fine sand, in an area of Valent-Wortman loamy fine sands, 3 to 9 percent slopes, 1,520 feet north and 130 feet west of the southeast corner of sec. 16, T. 3 S., R. 21 E.

A—0 to 5 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; weak fine and medium subangular structure; soft, very friable; few or common roots; neutral; gradual wavy boundary.
C—5 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; few fine roots in the upper part; neutral.

The depth to free carbonates ranges from 40 to more than 60 inches. Reaction is neutral or mildly alkaline throughout the profile.

The A horizon has value of 4 to 7 (3 to 5 moist) and chroma of 1 or 2. It dominantly is loamy fine sand but in some pedons is fine sand. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 to 4. It is fine sand or loamy fine sand.

Wanblee Series

The Wanblee series consists of moderately deep, well drained soils formed in siltstone residuum on uplands. Permeability is very slow. Slopes range from 2 to 6 percent.

Typical pedon of Wanblee loam, in an area of Norrest-Wanblee complex, 2 to 9 percent slopes, 440 feet south

and 2,110 feet east of the northwest corner of sec. 10, T. 4 W., R. 18 E.

E—0 to 2 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

Bt1—2 to 5 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure parting to moderate medium and fine subangular blocky; extremely hard, very firm, sticky and plastic; common fine flat roots; mildly alkaline; clear wavy boundary.

Bt2—5 to 12 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, sticky and plastic; common fine flat roots; strong effervescence; mildly alkaline; gradual wavy boundary.

Bkz1—12 to 18 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; few or common fine accumulations of salts and carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkz2—18 to 29 inches; light gray (2.5Y 7/2) loam, light brownish gray (10YR 6/2) moist; weak fine and medium subangular structure; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of salts and carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—29 to 60 inches; white (10YR 8/1) fractured soft siltstone, light brownish gray (10YR 6/2) moist; strong effervescence; moderately alkaline.

The depth to siltstone ranges from 20 to 40 inches. The E horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. It is medium acid to neutral. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is clay or clay loam. It is neutral or mildly alkaline.

Wendte Series

The Wendte series consists of deep, moderately well drained soils formed in clayey alluvium on flood plains and along narrow drainageways. Permeability is slow. Slopes range from 0 to 2 percent.

Typical pedon of Wendte clay, channeled, 130 feet north and 1,383 feet west of the southeast corner of sec. 9, T. 1 S., R. 25 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak thin and medium platy structure parting to weak fine and medium granular; slightly hard, friable, sticky and plastic; many fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

A2—4 to 8 inches; grayish brown (2.5Y 5/2) clay, very dark brown (10YR 2/2) moist, very dark grayish brown (2.5Y 3/2) crushed; weak medium and coarse subangular blocky structure parting to weak fine and medium granular; hard, friable, sticky and plastic; many fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

C1—8 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; thin bedding planes; hard, friable, sticky and plastic; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

C2—16 to 23 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine and medium distinct dark yellowish brown (10YR 3/4) stains; appears massive but has thin bedding planes; very hard, firm, sticky and plastic; common fine and medium roots; strong effervescence; mildly alkaline; clear smooth boundary.

C3—23 to 45 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; appears massive but has thin bedding planes; very hard, firm, sticky and plastic; few fine and medium roots; strong effervescence; mildly alkaline; gradual wavy boundary.

Cy—45 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; appears massive but has thin bedding planes; hard, firm, sticky and plastic; common fine and medium accumulations of gypsum; strong effervescence; moderately alkaline.

Free carbonates are at or near the surface. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay or clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 6 moist), and chroma of 1 to 4. It is silty clay or clay. In some pedons coarse textures are below a depth of 40 inches.

Weta Series

The Weta series consists of deep, well drained soils formed in sodium-rich alluvium on uplands and fans. Permeability is slow in the solum and moderately slow in the underlying material. Slopes range from 0 to 6 percent.

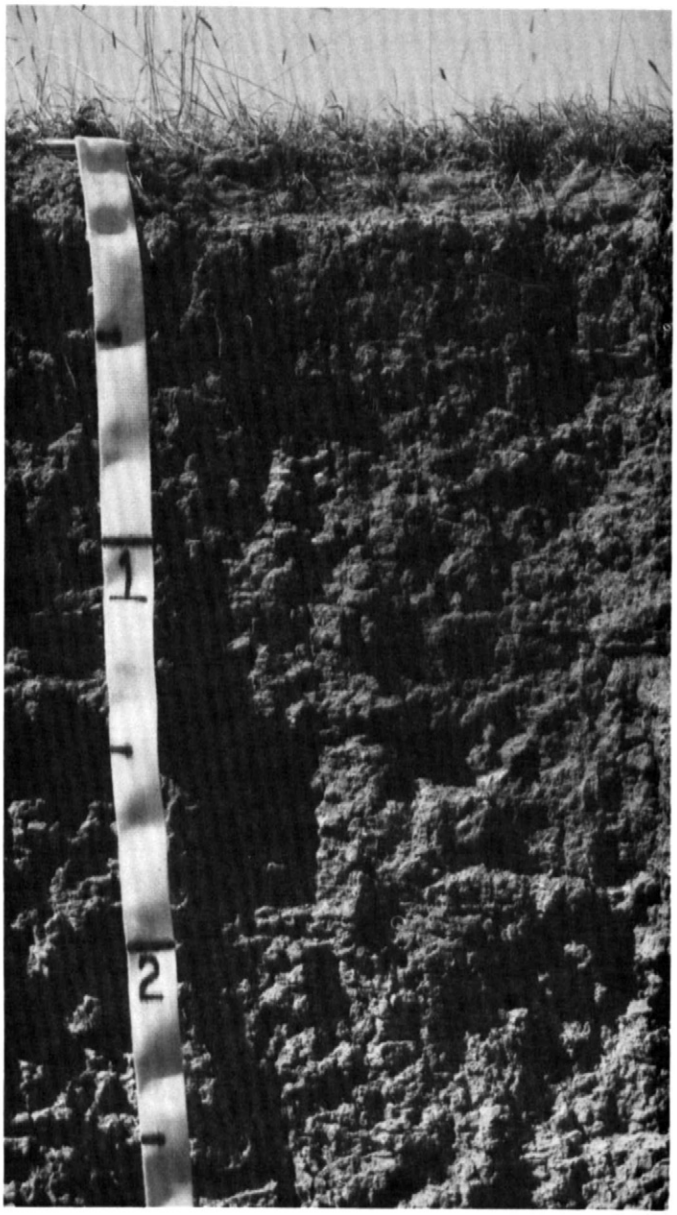

Figure 14.—Profile of Weta silt loam, 0 to 3 percent slopes. A dense claypan is at a depth of about 2 inches. Depth is marked in feet.

Typical pedon of Weta silt loam, 0 to 3 percent slopes (fig. 14), 1,875 feet north and 900 feet west of the southeast corner of sec. 21, T. 2 S., R. 18 E.

E—0 to 2 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak very fine and fine granular; soft, friable; many fine and medium roots; medium acid; abrupt smooth boundary.

Bt1—2 to 5 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; light brownish gray (10YR 6/2) coatings on tops of columns; strong fine and medium columnar structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, sticky and plastic; many fine flat roots; neutral; clear wavy boundary.

Bt2—5 to 11 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; many fine flat roots; strong effervescence; mildly alkaline; clear wavy boundary.

Bkz1—11 to 20 inches; light gray (10YR 6/1) and light brownish gray (10YR 6/2) silty clay loam, dark brown (10YR 3/3) moist, dark grayish brown (10YR 4/2) crushed; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; few fine flat roots; few or common fine accumulations of salts; few or common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

Bkz2—20 to 30 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable; common fine accumulations of salts and carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C1—30 to 55 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; appears massive but has weak bedding planes; hard, friable; few fine accumulations of carbonate and salts; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—55 to 60 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; appears massive but has weak bedding planes; slightly hard, friable; strong effervescence; moderately alkaline.

The depth to free carbonates is 0 to 8 inches. The thickness of the mollic epipedon ranges from 7 to 19 inches.

The E horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 to 2. It dominantly is silt loam but in some pedons is loam or very fine sandy loam. It ranges from medium acid to mildly alkaline. The Bt horizon has hue of 2.5Y or 10YR, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It ranges from neutral to moderately alkaline. The content of clay in this horizon ranges from 35 to 50 percent. The C horizon has hue of 2.5Y, 10YR, or 7.5YR. It ranges from mildly alkaline to strongly alkaline. It has few or common accumulations of salts. The sodium adsorption ratio ranges from 13 to 25.

Whitewater Series

The Whitewater series consists of moderately deep, well drained soils formed in sodium-rich, clayey shale residuum on uplands. When dry, these soils are characterized by cracks that are 0.5 to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is slight. Permeability is very slow. Slopes range from 0 to 3 percent.

Typical pedon of Whitewater clay, 0 to 3 percent slopes, 120 feet north and 1,929 feet east of the southwest corner of sec. 31, T. 3 S., R. 20 E.

A—0 to 3 inches; light gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; weak medium and coarse subangular blocky structure parting to weak fine granular; hard, firm, very sticky and very plastic; common fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bw1—3 to 14 inches; gray (10YR 5/1) clay, gray (10YR 5/1) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots; common intersecting slickensides; strong effervescence; moderately alkaline; gradual wavy boundary.

Bw2—14 to 21 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

Bkz—21 to 28 inches; light gray (10YR 7/1) shaly clay, light gray (10YR 6/1) moist; weak coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; common intersecting slickensides; few fine and medium accumulations of carbonate and salts; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—28 to 60 inches; light gray (10YR 6/1) shale, light gray (10YR 6/1) moist; strong effervescence; mildly alkaline.

The depth to bedrock ranges from 20 to 40 inches. Free carbonates are at or near the surface. Reaction is mildly alkaline to strongly alkaline throughout the profile.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay. The Bw horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8 (4 to 7 moist), and chroma of 1 or 2. The sodium adsorption ratio ranges from 10 to 23. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8 (4 to 7 moist), and chroma of 1 or 2.

Wortman Series

The Wortman series consists of moderately deep, well drained soils formed in siltstone residuum on uplands. Permeability is very slow. Slopes range from 2 to 9 percent.

Typical pedon of Wortman silt loam, in an area of Blackpipe-Wortman silt loams, 3 to 9 percent slopes, 2,000 feet south and 250 feet east of the northwest corner of sec. 7, T. 3 W., R. 19 E.

A—0 to 3 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; slightly acid; clear smooth boundary.

E—3 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable; many fine and medium roots; slightly acid; abrupt smooth boundary.

Bt1—5 to 9 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse columnar structure parting to moderate fine and medium subangular blocky; very hard, very firm, sticky and plastic; common fine and medium flat roots; neutral; clear smooth boundary.

Bt2—9 to 13 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; very hard, very firm, sticky and plastic; few fine flat roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bk—13 to 20 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine roots in the upper part; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Bkz—20 to 31 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and medium accumulations of salts; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—31 to 60 inches; light gray (10YR 7/2) siltstone, light brownish gray (10YR 6/2) moist; massive; strong effervescence; moderately alkaline.

The depth to siltstone ranges from 20 to 40 inches. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is loam, fine sandy loam, or loamy fine sand. It is slightly acid to mildly alkaline. The E horizon also is

slightly acid to mildly alkaline. It has value of 5 to 7 (3 or 4 moist) and chroma of 1 or 2. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is clay, clay loam, silty clay loam, or silty clay. It is neutral to moderately alkaline. The Cr horizon is mildly alkaline to strongly alkaline.

Formation of the Soils

Soil forms when chemical and physical processes act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are modified by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in the survey area.

Climate

Climate directly influences the rate of chemical and physical weathering. The survey area has a continental climate marked by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. It also favors a moderately slow rate of weathering or soil formation. The climate generally is uniform throughout the survey area. Therefore, climate alone does not account for differences among the soils in the survey area. Detailed information about the climate is given under the heading "General Nature of the Survey Area."

Plant and Animal Life

Plants, animals, insects, earthworms, bacteria, and fungi have important effects on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In the survey area the prairie grasses have had more influence than other living organisms on soil formation. As a result of these grasses, the surface layer of many soils has a moderate content of organic matter. Nunn soils are an example.

Earthworms, insects, and burrowing animals help to keep the soils open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

Parent Material

Parent material is the unconsolidated organic and mineral material in which a soil forms. It determines many of the chemical and physical characteristics of the soil, such as color, texture, reaction, and consistence. The rate of soil formation is more rapid in the more friable, loamy and silty parent material than in other kinds of parent material. Also, more changes take place, and the horizons are more distinct.

Most of the soils in the survey area formed in material weathered from the underlying bedrock. The remainder formed in old alluvial deposits on high terraces; recent alluvial deposits on flood plains, in swales, and in depressions on uplands; and in loess on uplands.

The bedrock in the eastern and northwestern parts of the survey area dominantly consists of clayey shale of the Pierre Formation. It is gray to light olive gray and has beds of bentonite and seams of limestone, iron, and manganese concretions. Kyle, Pierre, Promise, and Samsil are examples of soils formed in material weathered from the Pierre Formation.

The bedrock in the southwestern part of the survey area is mainly siltstone of the Brule Formation and clayey mudstone and shale of the Chadron Formation. The Brule Formation overlies the Chadron Formation. Blackpipe, Norrest, Wanblee, and Wortman are examples of soils formed in material weathered from the siltstone beds of the Brule Formation. Orella, Larvie, Metre, and Whitewater are examples of soils formed in material weathered from the Chadron Formation.

The Fox Hills Formation lies directly above the Pierre Formation. It is most extensive in the northwestern part of the survey area. It consists of interbedded silty shale, sandstone, and siltstone. Midway and Razor are examples of soils formed in material weathered from the Fox Hills Formation.

Alluvium is recently deposited sandy to clayey material on flood plains and older deposits of loamy and silty

material on high terraces, mainly in the northern part of the survey area. Bankard Variant, Craft, and Wendte are examples of soils formed in alluvium on flood plains. Nunn soils are an example of soils formed in alluvium on high terraces. Kolls soils are an example of soils formed in alluvium in depressions on uplands.

Colby and Norka are examples of soils formed in silty loess. They are on uplands.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the more sloping soils, such as Samsil soils, much of the rainfall is lost through runoff. As a result of the excessive runoff, a limited amount of moisture penetrates the surface and much of the soil material is lost through erosion. These soils have a thin surface layer and a low content of organic matter. Runoff is slower on Norka, Nunn, Savo, and other less sloping soils, and more water penetrates the surface. These soils are calcareous at a greater depth than the Samsil soils. Also, the horizons in which organic matter accumulates are thicker. Kolls soils are in depressions where water ponds. They have the colors characteristic of poorly drained soils.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. Generally, the degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable the longest time. These are the Dawes, Nunn, and Savo soils, which have well developed, distinct horizons. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Craft and Haverson soils are examples of young alluvial soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour farming. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed native range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are—

	Inches
Deep	more than 40
Moderately deep	20 to 40
Shallow	less than 20

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species that respond to continued overgrazing, at least initially, by increasing in relation to other plants in the community.

Invaders. On range, plants that are not a part of the original plant community that encroach into an area and grow after the native vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface soil.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to adversely affect the physical condition of the subsoil.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping erosional surface developed at the foot of a receding hill or mountain slope.

Pedisediment. A layer of sediment, eroded from the shoulder and back slope of an erosional slope, that lies on a pediment (foot slope).

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Potential native vegetation. The stabilized plant community on a particular range site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or

browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

	Percent
Level	0 to 1
Nearly level	0 to 2
Gently undulating	0 to 3
Gently sloping	2 to 6
Moderately sloping	6 to 9
Strongly sloping	9 to 15
Moderately steep	15 to 25
Steep	25 to 40
Very steep	more than 40

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-81 at Cottonwood, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	32.3	5.9	19.1	65	-31	22	0.39	0.11	0.62	1	4.9
February---	38.1	11.1	24.6	70	-25	33	.51	.15	.79	2	6.7
March------	45.5	18.7	32.1	78	-17	77	.95	.30	1.48	3	8.0
April------	60.9	31.7	46.3	89	8	226	1.77	.61	2.72	4	3.6
May--------	72.0	43.1	57.6	93	23	546	2.93	1.44	4.21	6	.2
June-------	81.8	52.8	67.3	104	34	819	3.39	1.55	4.97	7	.0
July-------	90.6	58.2	74.4	108	43	1,066	2.14	.98	3.12	5	.0
August-----	89.9	56.4	73.2	107	40	1,029	1.59	.54	2.45	4	.0
September--	79.8	45.0	62.4	103	24	672	1.16	.19	1.90	3	.0
October----	66.1	33.3	49.7	92	12	317	1.02	.08	1.73	3	1.1
November---	48.1	20.0	34.1	76	-9	53	.45	.12	.71	1	3.7
December---	36.5	10.5	23.5	66	-23	22	.42	.09	.67	2	5.8
Yearly:											
Average--	61.8	32.2	47.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	108	-31	---	---	---	---	---	---
Total----	---	---	---	---	---	4,882	16.72	14.19	19.28	41	34.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-81 at Cottonwood, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 11	May 18	May 30
2 years in 10 later than--	May 4	May 13	May 25
5 years in 10 later than--	Apr. 21	May 3	May 16
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 27	Sept. 18	Sept. 10
2 years in 10 earlier than--	Oct. 3	Sept. 23	Sept. 15
5 years in 10 earlier than--	Oct. 14	Oct. 3	Sept. 23

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-81 at Cottonwood, South Dakota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	150	130	110
8 years in 10	159	138	116
5 years in 10	175	152	130
2 years in 10	191	167	143
1 year in 10	199	175	150

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Absted silt loam	5,660	1.1
Ar	Arvada loam	8,055	1.5
As	Arvada-Slickspots complex	1,995	0.4
Ba	Badland	15,724	3.0
BcB	Beckton loam, 2 to 6 percent slopes	2,660	0.5
BdA	Beckton-Arvada loams, 0 to 2 percent slopes	2,475	0.5
BwC	Blackpipe-Wortman silt loams, 3 to 9 percent slopes	10,780	2.1
CaA	Cactusflat silty clay, 0 to 3 percent slopes	3,205	0.6
CbB	Cactusflat-Weta complex, 1 to 6 percent slopes	12,200	2.3
CeA	Cedarpass silt loam, 0 to 3 percent slopes	1,680	0.3
CfA	Cedarpass-Denby complex, 0 to 4 percent slopes	8,220	1.6
CoD	Colby silt loam, 6 to 15 percent slopes	1,815	0.3
Cv	Craft-Bankard Variant very fine sandy loams	1,285	0.2
EaB	Emigrant loam, 1 to 6 percent slopes	3,505	0.7
EbA	Emigrant-Beckton Variant loams, 0 to 2 percent slopes	620	0.1
EbC	Emigrant-Beckton Variant loams, 2 to 9 percent slopes	4,580	0.9
EcD	Emigrant-Conata complex, 6 to 15 percent slopes	1,570	0.3
ErB	Emigrant-Razor complex, 1 to 6 percent slopes	4,455	0.9
ErC	Emigrant-Razor complex, 6 to 9 percent slopes	6,770	1.3
ErD	Emigrant-Razor complex, 9 to 15 percent slopes	5,065	1.0
Fv	Fluvaquents, flooded	495	0.1
Ha	Haverson loam	3,630	0.7
Hc	Haverson-Craft complex	3,355	0.6
Ho	Hilmoe silty clay	790	0.2
HpC	Hisle silt loam, 0 to 9 percent slopes	9,705	1.9
HrC	Hisle-Rock outcrop complex, 0 to 9 percent slopes	4,105	0.8
HsC	Hisle-Slickspots complex, 0 to 9 percent slopes	4,340	0.8
Hu	Hurley silt loam	5,265	1.0
In	Interior loam	5,515	1.1
Io	Interior loam, channeled	8,530	1.6
IsB	Interior-Cedarpass-Badland complex, 0 to 6 percent slopes	12,780	2.5
Iv	Interior-Denby-Cedarpass complex, 0 to 3 percent slopes	9,005	1.7
Ko	Kolls clay	1,205	0.2
KyA	Kyle clay, 0 to 3 percent slopes	4,435	0.9
KyB	Kyle clay, 3 to 6 percent slopes	4,465	0.9
KyC	Kyle clay, 6 to 9 percent slopes	1,285	0.2
LcD	Larvie-Conata clays, 6 to 15 percent slopes	2,100	0.4
LhC	Larvie-Hisle complex, 2 to 9 percent slopes	5,950	1.1
Lo	Lohmiller silty clay	2,485	0.5
MhA	Metre-Hisle complex, 0 to 2 percent slopes	1,350	0.3
MhB	Metre-Hisle complex, 2 to 6 percent slopes	4,190	0.8
MoB	Metre-Larvie clays, 2 to 6 percent slopes	1,510	0.3
MyE	Midway silty clay loam, 15 to 40 percent slopes	4,385	0.8
NkD	Nihill-Samsil complex, 6 to 15 percent slopes	6,270	1.2
NoA	Norka silt loam, 0 to 3 percent slopes	1,735	0.3
NpD	Norka-Colby silt loams, 6 to 15 percent slopes	2,425	0.5
NrC	Norrest-Wanblee complex, 2 to 9 percent slopes	9,710	1.9
NuA	Nunn loam, 0 to 3 percent slopes	3,700	0.7
NuB	Nunn loam, 3 to 6 percent slopes	12,580	2.4
NuC	Nunn loam, 6 to 9 percent slopes	8,095	1.6
NuD	Nunn loam, 8 to 15 percent slopes	1,990	0.4
NwB	Nunn-Beckton loams, 2 to 6 percent slopes	8,635	1.7
NxD	Nunn-Nihill complex, 6 to 15 percent slopes	5,495	1.1
OrE	Orella-Rock outcrop complex, 3 to 45 percent slopes	7,480	1.4
PcB	Pierre clay, 3 to 6 percent slopes	4,580	0.9
PcC	Pierre clay, 6 to 9 percent slopes	14,110	2.7
PhB	Pierre-Hisle complex, 1 to 6 percent slopes	4,295	0.8
PkD	Pierre-Samsil clays, 6 to 15 percent slopes	59,390	11.4
PrA	Promise clay, 0 to 3 percent slopes	2,490	0.5
PsA	Promise-Hurley complex, 0 to 3 percent slopes	2,860	0.6
PsB	Promise-Hurley complex, 3 to 6 percent slopes	5,415	1.0
PuB	Promise-Pierre clays, 3 to 6 percent slopes	23,895	4.6
PuC	Promise-Pierre clays, 6 to 9 percent slopes	28,100	5.4
RhC	Razor-Hisle complex, 2 to 9 percent slopes	2,670	0.5

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
RmD	Razor-Midway silty clay loams, 6 to 15 percent slopes	17,690	3.4
SaF	Samsil clay, 15 to 40 percent slopes	14,695	2.8
ShE	Samsil-Hisle-Rock outcrop complex, 6 to 25 percent slopes	3,455	0.7
SpE	Samsil-Pierre clays, 15 to 25 percent slopes	35,570	6.8
SrF	Samsil-Rock outcrop complex, 25 to 60 percent slopes	625	0.1
SwB	Savo-Dawes silt loams, 2 to 6 percent slopes	1,795	0.3
VwC	Valent-Wortman loamy fine sands, 3 to 9 percent slopes	1,830	0.4
Wb	Wendte clay	830	0.2
Wc	Wendte clay, channeled	6,545	1.3
WeA	Weta silt loam, 0 to 3 percent slopes	4,610	0.9
WhA	Whitewater clay, 0 to 3 percent slopes	3,960	0.8
WsC	Wortman-Hisle complex, 2 to 9 percent slopes	860	0.2
	Water	4,450	0.8
	Areas not surveyed*	3,920	0.7
	Total	519,949	100.0

* Access to these areas was denied.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Winter wheat*	Oats	Grain sorghum	Cool-season grass	Alfalfa hay
	Bu	Bu	Bu	AUM**	Tons
Ab---------- Absted	14	22	---	0.8	0.5
Ar. Arvada					
As. Arvada-Slickspots					
Ba***. Badland					
BcB---------- Beckton	18	27	---	1.5	0.9
BdA---------- Beckton-Arvada	16	22	---	1.2	0.7
BwC---------- Blackpipe-Wortman	22	30	---	1.8	1.0
CaA---------- Cactusflat	34	47	---	2.3	1.4
CbB---------- Cactusflat-Weta	22	38	---	1.8	1.0
CeA---------- Cedarpass	27	38	---	2.3	1.3
CfA---------- Cedarpass-Denby	21	35	---	2.4	1.4
CoD. Colby					
Cv. Craft-Bankard Variant					
EaB---------- Emigrant	31	45	39	2.2	1.3
EbA. Emigrant-Beckton Variant					
EbC---------- Emigrant-Beckton Variant	20	30	---	1.5	0.9
EcD. Emigrant-Conata					
ErB---------- Emigrant-Razor	30	40	---	2.0	1.2
ErC---------- Emigrant-Razor	25	34	---	1.8	1.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat*	Oats	Grain sorghum	Cool-season grass	Alfalfa hay
	Bu	Bu	Bu	AUM**	Tons
ErD. Emigrant-Razor					
Fv***. Fluvaquents					
Ha---------- Haverson	30	45	---	3.2	1.9
Hc---------- Haverson-Craft	28	40	---	3.0	1.8
Ho---------- Hilmoe	34	50	40	3.5	2.1
HpC. Hisle					
HrC. Hisle-Rock outcrop					
HsC. Hisle-Slickspots					
Hu. Hurley					
In. Interior					
Io. Interior					
IsB. Interior-Cedarpass-Badland					
Iv. Interior-Denby-Cedarpass					
Ko. Kolls					
KyA---------- Kyle	40	30	---	2.3	1.4
KyB---------- Kyle	38	29	---	2.0	1.2
KyC---------- Kyle	31	24	---	1.8	1.0
LcD. Larvie-Conata					
LhC. Larvie-Hisle					
Lo---------- Lohmiller	49	32	---	3.3	2.0

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat*	Oats	Grain sorghum	Cool-season grass	Alfalfa hay
	Bu	Bu	Bu	AUM**	Tons
MhA---------- Metre-Hisle	17	28	---	1.2	0.7
MhB---------- Metre-Hisle	16	26	---	1.0	0.6
MoB---------- Metre-Larvie	21	30	---	1.8	1.0
MyE. Midway					
NkD. Nihill-Samsil					
NoA---------- Norka	36	49	40	2.8	1.7
NpD. Norka-Colby					
NrC---------- Norrest-Wanblee	17	25	---	1.2	0.7
NuA---------- Nunn	35	48	44	2.8	1.7
NuB---------- Nunn	32	46	41	2.2	1.3
NuC---------- Nunn	29	38	38	1.8	1.1
NuD---------- Nunn	---	---	---	1.2	0.7
NwB---------- Nunn-Beckton	22	39	---	2.0	1.2
NxD---------- Nunn-Nihill	---	---	---	1.0	0.6
OrE. Orella-Rock outcrop					
PcB---------- Pierre	27	36	29	2.0	1.2
PcC---------- Pierre	22	30	24	1.8	1.0
PhB---------- Pierre-Hisle	18	30	---	1.3	0.8
PkD. Pierre-Samsil					
PrA---------- Promise	36	50	44	2.4	1.5

See footnotes at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat*	Oats	Grain sorghum	Cool-season grass	Alfalfa hay
	Bu	Bu	Bu	AUM**	Tons
PsA---------- Promise-Hurley	24	38	33	2.0	1.2
PsB---------- Promise-Hurley	23	36	30	1.8	1.0
PuB---------- Promise-Pierre	33	43	38	2.2	1.3
PuC---------- Promise-Pierre	28	38	30	2.0	1.2
RhC---------- Razor-Hisle	17	26	---	1.2	0.7
RmD. Razor-Midway					
SaF. Samsil					
ShE. Samsil-Hisle-Rock outcrop					
SpE. Samsil-Pierre					
SrF. Samsil-Rock outcrop					
SwB---------- Savo-Dawes	33	46	---	2.2	1.3
VwC. Valent-Wortman					
Wb---------- Wendte	34	52	42	3.3	2.0
Wc---------- Wendte	---	---	---	2.5	1.5
WeA. Weta					
WhA. Whitewater					
WsC. Wortman-Hisle					

* Winter wheat is grown under a summer fallow system of management. The estimated yields can be expected only in alternate years.

** Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Ab---------- Absted	Claypan----------	1,400	1,200	700
Ar---------- Arvada	Thin Claypan----------	1,200	1,000	600
As*: Arvada----------	Thin Claypan----------	1,200	1,000	600
Slickspots.				
BcB---------- Beckton	Claypan----------	1,700	1,400	1,000
BdA*: Beckton----------	Claypan----------	1,800	1,500	1,000
Arvada----------	Thin Claypan----------	1,200	1,000	600
BwC*: Blackpipe----------	Silty----------	2,500	2,100	1,400
Wortman----------	Claypan----------	1,600	1,300	900
CaA---------- Cactusflat	Clayey----------	2,400	2,000	1,400
CbB*: Cactusflat----------	Clayey----------	2,400	2,000	1,400
Weta----------	Thin Claypan----------	1,200	1,000	600
CeA---------- Cedarpass	Silty----------	2,200	1,800	1,300
CfA*: Cedarpass----------	Silty----------	2,200	1,800	1,300
Denby----------	Clayey----------	2,200	1,800	1,300
CoD---------- Colby	Thin Upland----------	1,800	1,500	1,000
Cv*: Craft----------	Loamy Terrace----------	2,800	2,300	1,600
Bankard Variant---------	Sands----------	2,500	2,000	1,200
EaB---------- Emigrant	Silty----------	2,500	2,100	1,200
EbA*: Emigrant----------	Silty----------	2,000	1,700	1,200
Beckton Variant---------	Claypan----------	1,600	1,300	900
EbC*: Emigrant----------	Silty----------	2,500	2,100	1,600
Beckton Variant---------	Claypan----------	1,700	1,400	1,000

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
EcD*:				
Emigrant	Silty	2,300	1,900	1,300
Conata	Shallow Clay	1,700	1,400	1,000
ErB*, ErC*:				
Emigrant	Silty	2,500	2,100	1,500
Razor	Clayey	2,200	1,800	1,300
ErD*:				
Emigrant	Silty	2,300	1,900	1,300
Razor	Clayey	1,900	1,600	1,100
Fv* Fluvaquents	Subirrigated	4,300	3,900	3,100
Ha Haverson	Loamy Terrace	2,800	2,300	1,600
Hc* Haverson-Craft	Loamy Terrace	2,800	2,300	1,600
Ho Hilmoe	Clayey Overflow	3,600	3,000	2,100
HpC Hisle	Thin Claypan	1,100	900	500
HrC*:				
Hisle	Thin Claypan	1,100	900	500
Rock outcrop.				
HsC*:				
Hisle	Thin Claypan	1,100	900	500
Slickspots.				
Hu Hurley	Thin Claypan	1,300	1,100	700
In, Io Interior	Badland Overflow	2,200	2,100	1,500
IsB*:				
Interior	Badland Overflow	2,200	2,100	1,500
Cedarpass	Silty	2,200	1,800	1,300
Badland.				
Iv*:				
Interior	Badland Overflow	2,200	2,100	1,500
Denby	Clayey	2,200	1,800	1,300
Cedarpass	Silty	2,200	1,800	1,300
Ko Kolls	Closed Depression	2,800	2,500	1,700

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
KyA, KyB---- Kyle	Clayey----	2,300	1,900	1,300
KyC---- Kyle	Clayey----	2,200	1,800	1,300
LcD*: Larvie----	Clayey----	2,000	1,700	1,200
Conata----	Shallow Clay----	1,700	1,400	1,000
LhC*: Larvie----	Clayey----	2,000	1,700	1,200
Hisle----	Thin Clayey----	1,100	900	500
Lo---- Lohmiller	Loamy Terrace----	3,100	2,600	1,800
MhA*, MhB*: Metre----	Clayey----	2,200	1,800	1,300
Hisle----	Thin Claypan----	1,100	900	500
MoB*: Metre----	Clayey----	2,200	1,800	1,300
Larvie----	Clayey----	2,000	1,700	1,200
MyE---- Midway	Shallow----	1,600	1,400	950
NkD*: Nihill----	Shallow to Gravel----	1,200	1,000	600
Samsil----	Shallow Clay----	1,700	1,400	1,000
NoA---- Norka	Silty----	2,500	2,100	1,500
NpD*: Norka----	Silty----	2,300	1,900	1,300
Colby----	Thin Upland----	1,800	1,500	1,000
NrC*: Norrest----	Clayey----	2,200	1,700	1,200
Wanblee----	Thin Claypan----	1,000	900	500
NuA, NuB---- Nunn	Silty----	2,600	2,200	1,500
NuC, NuD---- Nunn	Silty----	2,400	2,000	1,400
NwB*: Nunn----	Silty----	2,600	2,200	1,500
Beckton----	Claypan----	1,700	1,400	1,000

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
NxD*:				
Nunn	Silty	2,400	2,000	1,400
Nihill	Shallow to Gravel	1,200	1,000	600
OrE*:				
Orella	Shallow Clay	1,300	1,100	800
Rock outcrop.				
PcB, PcC Pierre	Clayey	2,500	2,100	1,500
PhB*:				
Pierre	Clayey	2,500	2,100	1,500
Hisle	Thin Claypan	1,100	900	500
PkD*:				
Pierre	Clayey	2,400	2,000	1,400
Samsil	Shallow Clay	1,700	1,400	1,000
PrA Promise	Clayey	2,500	2,100	1,500
PsA*, PsB*:				
Promise	Clayey	2,500	2,100	1,500
Hurley	Thin Claypan	1,300	1,100	700
PuB*, PuC* Promise-Pierre	Clayey	2,500	2,100	1,500
RhC*:				
Razor	Clayey	2,200	1,800	1,300
Hisle	Thin Claypan	1,100	900	500
RmD*:				
Razor	Clayey	1,900	1,600	1,100
Midway	Shallow	1,700	1,400	1,000
SaF Samsil	Shallow Clay	1,700	1,400	1,000
ShE*:				
Samsil	Shallow Clay	1,700	1,400	1,000
Hisle	Thin Claypan	1,100	900	500
Rock outcrop.				
SpE*:				
Samsil	Shallow Clay	1,700	1,400	1,000
Pierre	Clayey	2,000	1,700	1,200
SrF*:				
Samsil	Shallow Clay	1,400	1,200	900

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
SrF*: Rock outcrop.				
SwB*: Savo	Silty	2,500	2,100	1,500
Dawes	Silty	2,300	1,900	1,300
VwC*: Valent	Sands	2,500	2,000	1,200
Wortman	Sandy	1,600	1,300	900
Wb, Wc Wendte	Clayey Overflow	3,700	3,100	2,200
WeA Weta	Thin Claypan	1,200	1,000	600
WhA Whitewater	Dense Clay	1,800	1,400	800
WsC*: Wortman	Sandy	1,600	1,300	900
Hisle	Thin Claypan	1,100	900	500

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ab---------- Absted	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Ar. Arvada					
As*: Arvada.					
Slickspots.					
Ba*. Badland					
BcB---------- Beckton	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	---	---	---	---
BdA*: Beckton----------	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	---	---	---	---
Arvada.					
BwC*: Blackpipe--------	Lilac, Siberian peashrub, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---
Wortman----------	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
CaA---------- Cactusflat	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
CbB*: Cactusflat	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Weta.					
CeA--- Cedarpass	Siberian peashrub, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
CfA*: Cedarpass	Siberian peashrub, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
Denby	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
CoD--- Colby	Siberian peashrub, silver buffaloberry, lilac, Peking cotoneaster, skunkbush sumac.	Eastern redcedar, Russian-olive, ponderosa pine, Rocky Mountain juniper, green ash, honeylocust.	Siberian elm------	---	---
Cv*: Craft	American plum, lilac.	Tatarian honeysuckle.	Eastern redcedar, blue spruce, ponderosa pine, Russian-olive, hackberry, green ash.	Siberian elm, honeylocust.	Eastern cottonwood.
Bankard Variant--	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine----	---	---
EaB--- Emigrant	Siberian peashrub, lilac, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
EbA*, EbC*:					
Emigrant	Siberian peashrub, lilac, Peking cotoneaster, skunkbush sumac.	Green ash, Russian-olive, Chinese elm.	---	---	---
Beckton Variant	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle, lilac, silver buffaloberry.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
EcD*:					
Emigrant	Siberian peashrub, lilac, Peking cotoneaster, skunkbush sumac.	Green ash, Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---
Conata.					
ErB*, ErC*, ErD*:					
Emigrant	Siberian peashrub, lilac, Peking cotoneaster, skunkbush sumac.	Green ash, hackberry, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeylocust, ponderosa pine.	---	---
Razor	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Fv*. Fluvaquents					
Ha Haverson	Lilac, American plum.	Tatarian honeysuckle.	Ponderosa pine, green ash, hackberry, Russian-olive, blue spruce, eastern redcedar.	Siberian elm, honeylocust.	Eastern cottonwood.
Hc*:					
Haverson	Lilac, American plum.	Tatarian honeysuckle.	Ponderosa pine, green ash, hackberry, Russian-olive, blue spruce, eastern redcedar.	Siberian elm, honeylocust.	Eastern cottonwood.
Craft	American plum, lilac.	Tatarian honeysuckle.	Eastern redcedar, blue spruce, ponderosa pine, Russian-olive, hackberry, green ash.	Siberian elm, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ho---------- Hilmoe	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
HpC. Hisle					
HrC*: Hisle.					
Rock outcrop.					
HsC*: Hisle.					
Slickspots.					
Hu. Hurley					
In, Io. Interior					
IsB*: Interior.					
Cedarpass--------	Siberian peashrub, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
Badland.					
Iv*: Interior.					
Denby----------	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Cedarpass--------	Siberian peashrub, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
Ko. Kolls					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
KyA, KyB, KyC----- Kyle	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
LcD*: Larvie-----------	Tatarian honeysuckle, lilac, Siberian peashrub, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Conata.					
LhC*: Larvie-----------	Tatarian honeysuckle, lilac, Siberian peashrub, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Hisle.					
Lo---------- Lohmiller	American plum, lilac.	Tatarian honeysuckle.	Ponderosa pine, blue spruce, green ash, hackberry, Russian-olive, eastern redcedar.	Honeylocust, Siberian elm.	Eastern cottonwood.
MhA*, MhB*: Metre----------	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Hisle.					
MoB*: Metre----------	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Larvie-----------	Tatarian honeysuckle, lilac, Siberian peashrub, American plum.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, Manchurian crabapple.	Siberian elm, honeylocust.	---	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MyE. Midway					
NkD*: Nihill.					
Samsil.					
NoA---------- Norka	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm------	---
NpD*: Norka----------	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm------	---
Colby----------	Siberian peashrub, skunkbush sumac, silver buffaloberry, lilac, Peking cotoneaster.	Eastern redcedar, Russian-olive, ponderosa pine, Rocky Mountain juniper, green ash, honeylocust.	Siberian elm------	---	---
NrC*: Norrest----------	Siberian peashrub, Peking cotoneaster, skunkbush sumac, lilac.	Russian-olive, green ash, hackberry, eastern redcedar, Rocky Mountain juniper.	Siberian elm, ponderosa pine, honeylocust.	---	---
Wanblee.					
NuA, NuB, NuC, NuD---------- Nunn	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, Siberian peashrub.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm------	---
NwB*: Nunn----------	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, Siberian peashrub.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm------	---
Beckton.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
NxD*:					
Nunn	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, plum, caragana.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive.	Siberian elm	---
Nihill.					
OrE*:					
Orella.					
Rock outcrop.					
PcB, PcC Pierre	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
PhB*:					
Pierre	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Hisle.					
PkD*:					
Pierre	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Samsil.					
PrA Promise	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
PsA*, PsB*:					
Promise	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Hurley.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
PuB*, PuC*: Promise	Tatarian honeysuckle, American plum, Siberian peashrub, lilac.	Ponderosa pine, green ash, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Pierre	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
RhC*: Razor	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Hisle.					
RmD*: Razor	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Midway.					
SaF. Samsil					
ShE*: Samsil.					
Hisle.					
Rock outcrop.					
SpE*: Samsil.					
Pierre.					
SrF*: Samsil.					
Rock outcrop.					
SwB*: Savo	American plum, lilac.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash.	Siberian elm------	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
SwB*: Dawes	Tatarian honeysuckle, American plum, lilac, Siberian peashrub.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Honeylocust, Siberian elm.	---	---
VwC*: Valent	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine	---	---
Wortman	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	Siberian elm, ponderosa pine, green ash, Russian-olive.	---	---	---
Wb, Wc: Wendte	Siberian peashrub, Tatarian honeysuckle, lilac, American plum, skunkbush sumac.	Hackberry, eastern redcedar, Rocky Mountain juniper, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust, green ash.	---	---
WeA. Weta					
WhA. Whitewater					
WsC*: Wortman	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, silver buffaloberry, lilac, Tatarian honeysuckle.	Siberian elm, ponderosa pine, green ash, Russian-olive.	---	---	---
Hisle.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ab--- Absted	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Ar--- Arvada	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.
As*: Arvada---	Severe: flooding, excess sodium, excess salt.	Severe: excess sodium, excess salt.	Severe: excess sodium, excess salt.	Slight.
Slickspots.				
Ba*. Badland				
BcB--- Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
BdA*: Beckton---	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Arvada---	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
BwC*: Blackpipe---	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Wortman---	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
CaA--- Cactusflat	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
CbB*: Cactusflat---	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
Weta---	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
CeA--- Cedarpass	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight.
CfA*: Cedarpass---	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
Denby---	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
CoD---------- Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Cv*:				
Craft----------	Severe: flooding.	Slight----------	Slight----------	Slight.
Bankard Variant------	Severe: flooding.	Slight----------	Moderate: flooding.	Severe: erodes easily.
EaB---------- Emigrant	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight.
EbA*:				
Emigrant----------	Slight----------	Slight----------	Slight----------	Slight.
Beckton Variant------	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
EbC*:				
Emigrant----------	Slight----------	Slight----------	Severe: slope.	Slight.
Beckton Variant------	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
EcD*:				
Emigrant----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Conata----------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
ErB*:				
Emigrant----------	Slight----------	Slight----------	Moderate: slope, depth to rock.	Slight.
Razor----------	Slight----------	Slight----------	Moderate: slope.	Slight.
ErC*:				
Emigrant----------	Slight----------	Slight----------	Severe: slope.	Slight.
Razor----------	Slight----------	Slight----------	Severe: slope.	Slight.
ErD*:				
Emigrant----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Razor----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Fv*. Fluvaquents				

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ha---------- Haverson	Severe: flooding.	Moderate: dusty.	Slight----------	Moderate: dusty.
Hc*: Haverson----------	Severe: flooding.	Moderate: dusty.	Slight----------	Moderate: dusty.
Craft----------	Severe: flooding.	Slight----------	Slight----------	Slight.
Ho---------- Hilmoe	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Slight.
HpC---------- Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
HrC*: Hisle----------	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Rock outcrop.				
HsC*: Hisle----------	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Slickspots.				
Hu---------- Hurley	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
In, Io---------- Interior	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
IsB*: Interior----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Cedarpass----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
Badland.				
Iv*: Interior----------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Denby----------	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Cedarpass----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight.
Ko---------- Kolls	Severe: ponding, percs slowly, too clayey.	Severe: too clayey, ponding, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: too clayey, ponding.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
KyA---------- Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
KyB---------- Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
KyC---------- Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
LcD*: Larvie----------	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Conata----------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: erodes easily.
LhC*: Larvie----------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
Hisle----------	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Lo---------- Lohmiller	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
MhA*: Metre----------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.
Hisle----------	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
MhB*: Metre----------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
Hisle----------	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
MoB*: Metre----------	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
MoB*: Larvie	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
MyE: Midway	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope.
NkD*: Nihill	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: dusty.
Samsil	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
NoA: Norka	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
NoD*: Norka	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
NrC*: Norrest	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Slight.
Wanblee	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
NuA: Nunn	Slight	Slight	Moderate: small stones.	Moderate: dusty.
NuB: Nunn	Slight	Slight	Moderate: slope.	Moderate: dusty.
NuC: Nunn	Slight	Slight	Severe: slope.	Moderate: dusty.
NuD: Nunn	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: dusty.
NwB*: Nunn	Slight	Slight	Moderate: slope.	Moderate: dusty.
Beckton	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
NxD*: Nunn	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
NxD*:				
Nihill	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: dusty.
OrE*:				
Orella	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Rock outcrop.				
PcB	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
Pierre				
PcC	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
Pierre				
PhB*:				
Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
PkD*:				
Pierre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
Samsil	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
PrA	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
Promise				
PsA*:				
Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
Hurley	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
PsB*:				
Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
Hurley	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PuB*: Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.
Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, depth to rock.	Moderate: too clayey.
PuC*: Promise	Moderate: percs slowly.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.
RhC*: Razor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: slope, excess sodium.	Moderate: dusty.
RmD*: Razor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Slight.
SaF: Samsil	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
ShE*: Samsil	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: slope, excess sodium.	Moderate: dusty.
Rock outcrop.				
SpE*: Samsil	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Pierre	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
SrF*: Samsil	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SrF*: Rock outcrop.				
SwB*:				
Savo	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Dawes	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Slight.
VwC*:				
Valent	Slight	Slight	Severe: slope.	Slight.
Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: slope, excess sodium.	Slight.
Wb Wendte	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Wc Wendte	Severe: flooding.	Slight	Moderate: flooding.	Slight.
WeA Weta	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
WhA Whitewater	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey, erodes easily.
WsC*:				
Wortman	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Hisle	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.

*See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
Ab---------- Absted	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Ar---------- Arvada	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
As*: Arvada----------	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Slickspots.									
Ba*. Badland									
BcB---------- Beckton	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BdA*: Beckton----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Arvada----------	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
BwC*: Blackpipe---------	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wortman----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CaA---------- Cactusflat	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CbB*: Cactusflat--------	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Weta----------	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CeA---------- Cedarpass	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
CfA*: Cedarpass---------	Poor	Good	Good	Fair	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Denby----------	Poor	Fair	Good	Fair	Very poor.	Poor	Very poor.	Very poor.	Very poor.
CoD---------- Colby	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Cv*: Craft----------	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
Cv*:									
Bankard Variant---	Very poor.	Fair	Fair	Poor	Fair	Good	Very poor.	Very poor.	Fair.
EaB---------- Emigrant	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
EbA*:									
Emigrant----------	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very. poor.
Beckton Variant---	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
EbC*:									
Emigrant----------	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Beckton Variant---	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
EcD*:									
Emigrant----------	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Conata----------	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ErB*:									
Emigrant----------	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Razor----------	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ErC*:									
Emigrant----------	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Razor----------	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ErD*:									
Emigrant----------	Very poor.	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Razor----------	Very poor.	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Fv*. Fluvaquents									
Ha---------- Haverson	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good.
Hc*:									
Haverson----------	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good.
Craft----------	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
Ho---------- Hilmoe	Good	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
HpC---------- Hisle	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
HrC*:									
Hisle----------	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
HsC*:									
Hisle----------	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Slickspots.									
Hu---------- Hurley	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
In, Io---------- Interior	Very poor.	Fair	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.
IsB*:									
Interior----------	Very poor.	Fair	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Cedarpass---------	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Badland.									
Iv*:									
Interior----------	Very poor.	Fair	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Denby----------	Poor	Fair	Good	Fair	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Cedarpass---------	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Ko---------- Kolls	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
KyA---------- Kyle	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
KyB, KyC---------- Kyle	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
LcD*:									
Larvie----------	Very poor.	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Conata----------	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
LhC*:									
Larvie----------	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
LhC*:									
Hisle	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Lo Lohmiller	Fair	Good	Good	Good	Poor	Good	Very poor.	Very poor.	Good.
MhA*, MhB*:									
Metre	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
MoB*:									
Metre	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Larvie	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
MyE Midway	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NkD*:									
Nihill	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Samsil	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NoA Norka	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NpD*:									
Norka	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Colby	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NrC*:									
Norrest	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wanblee	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NuA, NuB Nunn	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NuC Nunn	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NuD Nunn	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NwB*:									
Nunn	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
NwB*:									
Beckton	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NxD*:									
Nunn	Poor	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Nihill	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
OrE*:									
Orella	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
PcB	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Pierre									
PcC	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Pierre									
PhB*:									
Pierre	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PkD*:									
Pierre	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Samsil	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PrA	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Promise									
PsA*, PsB*:									
Promise	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hurley	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PuB*:									
Promise	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Pierre	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PuC*:									
Promise	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Pierre	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
RhC*:									
Razor	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
RmD*:									
Razor	Very poor.	Fair	Good	Fair	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Midway	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SaF Samsil	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ShE*:									
Samsil	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
SpE*:									
Samsil	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Pierre	Very poor.	Very poor.	Good	Poor	Very poor.	Fair	Very poor.	Very poor.	Very poor.
SrF*:									
Samsil	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
SwB*:									
Savo	Fair	Good	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Dawes	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
VwC*:									
Valent	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wortman	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Wb Wendte	Fair	Fair	Fair	Fair	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Wc Wendte	Very poor.	Fair	Fair	Fair	Very poor.	Poor	Very poor.	Very poor.	Fair.
WeA Weta	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Planted hardwood trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas	Native hardwood trees
WhA---------- Whitewater	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
WsC*:									
Wortman----------	Poor	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Hisle----------	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ab---------- Absted	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Ar---------- Arvada	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
As*: Arvada----------	Moderate: too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Slickspots.					
Ba*. Badland					
BcB---------- Beckton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
BdA*: Beckton----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Arvada----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
BwC*: Blackpipe--------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Wortman----------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
CaA---------- Cactusflat	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
CbB*: Cactusflat-------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Weta----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
CeA---------- Cedarpass	Slight----------	Slight----------	Slight----------	Slight----------	Severe: low strength.
CfA*: Cedarpass--------	Slight----------	Slight----------	Slight----------	Slight----------	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CfA*: Denby	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
CoD: Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Cv*: Craft	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Bankard Variant	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
EaB: Emigrant	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
EbA*, EbC*: Emigrant	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Beckton Variant	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
EcD*: Emigrant	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Conata	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
ErB*, ErC*: Emigrant	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Razor	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
ErD*: Emigrant	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Razor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Fv*. Fluvaquents					

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ha---------- Haverson	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Hc*: Haverson---------	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Craft----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ho---------- Hilmoe	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
HpC---------- Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
HrC*: Hisle----------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Rock outcrop.					
HsC*: Hisle----------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Slickspots.					
Hu---------- Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
In, Io---------- Interior	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
IsB*: Interior---------	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Cedarpass--------	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.
Badland.					
Iv*: Interior---------	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Denby----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Cedarpass--------	Slight----------	Slight----------	Slight----------	Slight----------	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ko Kolls	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: low strength, ponding, shrink-swell.
KyA, KyB, KyC Kyle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
LcD*: Larvie	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Conata	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
LhC*: Larvie	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Lo Lohmiller	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
MhA*, MhB*: Metre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
MoB*: Metre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Larvie	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
MyE Midway	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
NkD*: Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
NkD*: Samsil	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
NoA---- Norka	Slight----	Slight----	Slight----	Slight----	Moderate: frost action.
NpD*: Norka	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: frost action.
Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
NrC*: Norrest	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Wanblee	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
NuA, NuB, NuC---- Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
NuD---- Nunn	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
NwB*: Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Beckton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
NxD*: Nunn	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
OrE*: Orella	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Rock outcrop.					
PcB, PcC---- Pierre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
PhB*: Pierre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
PkD*: Pierre	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Samsil	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
PrA Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
PsA*, PsB*: Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hurley	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
PuB*, PuC*: Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Pierre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
RhC*: Razor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
RmD*: Razor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
SaF---------- Samsil	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
ShE*: Samsil----------	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Hisle----------	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Rock outcrop.					
SpE*: Samsil----------	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Pierre----------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
SrF*: Samsil----------	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Rock outcrop.					
SwB*: Savo----------	Slight----------	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Dawes----------	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
VwC*: Valent----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
Wortman----------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Wb---------- Wendte	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Wc---------- Wendte	Moderate: flooding, too clayey.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, flooding.	Severe: shrink-swell, low strength, flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
WeA---------- Weta	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
WhA---------- Whitewater	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
WsC*: Wortman----------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Hisle----------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab---------- Absted	Severe: percs slowly.	Slight----------	Severe: excess salt.	Slight----------	Fair: thin layer.
Ar---------- Arvada	Severe: percs slowly.	Severe: flooding.	Severe: excess salt.	Moderate: flooding.	Good.
As*: Arvada----------	Severe: percs slowly.	Severe: flooding.	Severe: excess salt.	Moderate: flooding.	Good.
Slickspots.					
Ba*. Badland					
BcB---------- Beckton	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey, excess sodium.	Slight----------	Poor: too clayey, excess salt, excess sodium.
BdA*: Beckton----------	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey, excess sodium.	Slight----------	Poor: too clayey, excess salt, excess sodium.
Arvada----------	Severe: percs slowly.	Slight----------	Severe: excess salt.	Slight----------	Good.
BwC*: Blackpipe----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Wortman----------	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, excess sodium.	Severe: depth to rock.	Poor: area reclaim, excess sodium.
CaA---------- Cactusflat	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight----------	Poor: too clayey.
CbB*: Cactusflat---------	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
Weta----------	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
CeA---------- Cedarpass	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CfA*: Cedarpass	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Denby	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
CoD: Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Cv*: Craft	Moderate: flooding, percs slowly.	Severe: seepage.	Moderate: flooding, too sandy.	Moderate: flooding.	Good.
Bankard Variant	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
EaB: Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
EbA*: Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Beckton Variant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
EbC*: Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Beckton Variant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
EcD*: Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Conata	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
ErB*: Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ErB*: Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
ErC*, ErD*: Emigrant	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Fv*. Fluvaquents					
Ha Haverson	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Hc*: Haverson	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Craft	Moderate: flooding, percs slowly.	Severe: seepage.	Moderate: flooding, too sandy.	Moderate: flooding.	Good.
Ho Hilmoe	Severe: percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
HpC Hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
HrC*: Hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Rock outcrop.					
HsC*: Hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Slickspots.					
Hu Hurley	Severe: percs slowly.	Slight	Severe: excess sodium.	Slight	Poor: area reclaim, hard to pack, excess sodium.
In, Io Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
IsB*:					
Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Cedarpass	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Badland.					
Iv*:					
Interior	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Denby	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Cedarpass	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Ko Kolls	Severe: percs slowly, ponding.	Slight	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
KyA Kyle	Severe: percs slowly.	Slight	Slight	Slight	Poor: hard to pack.
KyB Kyle	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Poor: hard to pack.
KyC Kyle	Severe: percs slowly.	Severe: slope.	Slight	Slight	Poor: hard to pack.
LcD*:					
Larvie	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Conata	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
LhC*:					
Larvie	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Lo Lohmiller	Severe: percs slowly.	Slight	Moderate: flooding.	Moderate: flooding.	Poor: hard t pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MhA*, MhB*:					
Metre	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
MoB*:					
Metre	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Larvie	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
MyE	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
NkD*:					
Nihill	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Samsil	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
NoA	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Norka					
NpD*:					
Norka	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
NrC*:					
Norrest	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Wanblee	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, excess sodium.	Severe: depth to rock.	Poor: area reclaim, excess sodium.
NuA	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Nunn					
NuB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Nunn					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
NuC---------- Nunn	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
NuD---------- Nunn	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
NwB*: Nunn----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Beckton----------	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey, excess sodium.	Slight----------	Poor: too clayey, excess salt, excess sodium.
NxD*: Nunn----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Nihill----------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
OrE*: Orella----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Rock outcrop.					
PcB---------- Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PcC---------- Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PhB*: Pierre----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Hisle----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PkD*: Pierre----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Samsil----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PrA---------- Promise	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
PsA*:					
Promise----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Hurley----------	Severe: percs slowly.	Slight----------	Severe: excess sodium.	Slight----------	Poor: area reclaim, hard to pack, excess sodium.
PsB*:					
Promise----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Hurley----------	Severe: percs slowly.	Slight----------	Severe: excess sodium.	Slight----------	Poor: area reclaim, hard to pack, excess sodium.
PuB*:					
Promise----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Pierre----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PuC*:					
Promise----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Pierre----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
RhC*:					
Razor----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Hisle----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
RmD*:					
Razor----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Midway----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SaF---------- Samsil	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
ShE*: Samsil----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Hisle----------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Rock outcrop.					
SpE*: Samsil----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Pierre----------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
SrF*: Samsil----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
SwB*: Savo----------	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Dawes----------	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Poor: thin layer.
VwC*: Valent----------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight----------	Poor: too sandy.
Wortman----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey, excess sodium.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Wb---------- Wendte	Severe: percs slowly.	Slight----------	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
Wc---------- Wendte	Severe: percs slowly, flooding.	Severe: flooding.	Severe: too clayey, flooding.	Severe: flooding.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WeA---------- Weta	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight----------	Poor: too clayey.
WhA---------- Whitewater	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
WsC*: Wortman----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey, excess sodium.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Hisle----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab Absted	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Ar Arvada	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
As*: Arvada	Poor: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
Slickspots.				
Ba*. Badland				
BcB Beckton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
BdA*: Beckton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Arvada	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, excess salt.
BwC*: Blackpipe	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Wortman	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium.
CaA Cactusflat	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CbB*: Cactusflat	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Weta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CeA Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CfA*: Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CfA*:				
Denby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CoD	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Colby				
Cv*:				
Craft	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Bankard Variant	Good	Probable	Probable	Poor: small stones, area reclaim.
EaB	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Emigrant				
EbA*, EbC*:				
Emigrant	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Beckton Variant	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
EcD*:				
Emigrant	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Conata	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
ErB*, ErC*, ErD*:				
Emigrant	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Razor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.
Fv*.				
Fluvaquents				
Ha	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Haverson				
Hc*:				
Haverson	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hc*:				
Craft	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Ho Hilmoe	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
HpC Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
HrC*:				
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Rock outcrop.				
HsC*:				
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Slickspots.				
Hu Hurley	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
In, Io Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
IsB*:				
Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Badland.				
Iv*:				
Interior	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Denby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Cedarpass	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ko Kolls	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
KyA, KyB, KyC--------- Kyle	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LcD*: Larvie----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Conata----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
LhC*: Larvie----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hisle----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Lo---------- Lohmiller	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MhA*, MhB*: Metre----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hisle----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
MoB*: Metre----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Larvie----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MyE---------- Midway	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
NkD*: Nihill----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
NkD*: Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
NoA Norka	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
NpD*: Norka	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
NrC*: Norrest	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Wanblee	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess salt, excess sodium.
NuA, NuB, NuC, NuD Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
NwB*: Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Beckton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
NxD*: Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Nihill	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
OrE*: Orella	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Rock outcrop.				
PcB, PcC Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PhB*:				
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
PkD*:				
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
PrA Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PsA*, PsB*:				
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hurley	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
PuB*, PuC*:				
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RhC*:				
Razor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
RmD*:				
Razor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RmD*: Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
SaF: Samsil	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
ShE*: Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Rock outcrop.				
SpE*: Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
SrF*: Samsil	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
Rock outcrop.				
SwB*: Savo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Dawes	Good	Probable	Improbable: too sandy.	Poor: thin layer.
VwC*: Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Wortman	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Wb: Wendte	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Wc---------- Wendte	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WeA---------- Weta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
WhA---------- Whitewater	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WsC*: Wortman----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Hisle----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ab---------- Absted	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Percs slowly---	Erodes easily	Excess sodium, erodes easily.
Ar---------- Arvada	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly.	Percs slowly---	Excess salt, excess sodium, erodes easily.
As*: Arvada---------- Slickspots.	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly.	Percs slowly---	Excess salt, excess sodium, erodes easily.
Ba*. Badland						
BcB---------- Beckton	Moderate: slope.	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, slope, excess sodium.	Percs slowly---	Excess salt, excess sodium.
BdA*: Beckton----------	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly---	Excess salt, excess sodium.
Arvada----------	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly.	Percs slowly---	Excess sodium, excess salt.
BwC*: Blackpipe--------	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Wortman----------	Moderate: depth to rock, slope.	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium.	Depth to rock	Depth to rock, percs slowly, excess sodium.
CaA---------- Cactusflat	Moderate: seepage.	Slight---------	Deep to water	Slow intake, percs slowly.	Favorable------	Percs slowly.
CbB*: Cactusflat-------	Moderate: seepage, slope.	Slight---------	Deep to water	Slow intake, percs slowly, slope.	Favorable------	Percs slowly.
Weta----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Percs slowly, slope.	Erodes easily	Erodes easily, percs slowly.
CeA---------- Cedarpass	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
CfA*:						
Cedarpass	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Denby	Moderate: seepage.	Severe: piping.	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
CoD:						
Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Cv*:						
Craft	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Bankard Variant	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing.	Erodes easily, too sandy, soil blowing.	Erodes easily, droughty, rooting depth.
EaB:						
Emigrant	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
EbA*:						
Emigrant	Moderate: seepage, depth to rock.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Beckton Variant	Moderate: depth to rock.	Moderate: excess salt.	Deep to water	Percs slowly, depth to rock.	Depth to rock	Depth to rock, percs slowly.
EbC*:						
Emigrant	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Beckton Variant	Moderate: depth to rock, slope.	Moderate: excess salt.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock	Depth to rock, percs slowly.
EcD*:						
Emigrant	Severe: slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Conata	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
ErB*, ErC*:						
Emigrant	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Razor	Moderate: depth to rock, slope.	Severe: excess salt.	Deep to water	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ErD*:						
Emigrant	Severe: slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Razor	Severe: slope.	Severe: excess salt.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Fv*.						
Fluvaquents						
Ha	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Haverson						
Hc*:						
Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Craft	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ho	Moderate: seepage.	Severe: piping.	Deep to water	Slow intake, percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
Hilmoe						
HpC	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
Hisle						
HrC*:						
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
Rock outcrop.						
HsC*:						
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
Slickspots.						
Hu	Slight	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily	Excess sodium, erodes easily.
Hurley						
In, Io	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Interior						
IsB*:						
Interior	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Cedarpass	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Badland.						

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Iv*:						
Interior	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Denby	Moderate: seepage.	Severe: piping.	Deep to water	Slow intake, percs slowly.	Favorable	Percs slowly.
Cedarpass	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ko Kolls	Slight	Severe: hard to pack, ponding.	Percs slowly, ponding.	Slow intake, ponding.	Ponding, erodes easily, percs slowly.	Wetness, erodes easily.
KyA Kyle	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
KyB, KyC Kyle	Moderate: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
LcD*:						
Larvie	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Conata	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
LhC*:						
Larvie	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
Lo Lohmiller	Slight	Moderate: hard to pack, piping.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
MhA*:						
Metre	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily, percs slowly.	Erodes easily, droughty, depth to rock.
Hisle	Moderate: depth to rock.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
MhB*:						
Metre	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily, percs slowly.	Erodes easily, droughty, depth to rock.
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MoB*: Metre	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily, percs slowly.	Erodes easily, droughty, depth to rock.
Larvie	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
MyE---- Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
NkD*: Nihill	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Droughty, slope.	Slope----------	Slope, droughty.
Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
NoA---- Norka	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
NpD*: Norka	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
NrC*: Norrest	Moderate: depth to rock, slope.	Moderate: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Wanblee	Moderate: depth to rock, slope.	Severe: excess sodium.	Deep to water	Percs slowly, excess sodium, slope.	Depth to rock	Depth to rock, excess salt, excess sodium.
NuA---- Nunn	Slight---------	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
NuB, NuC---- Nunn	Moderate: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly---	Percs slowly.
NuD---- Nunn	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
NwB*: Nunn	Moderate: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly---	Percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
NwB*:						
Beckton	Moderate: slope.	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, slope, excess sodium.	Percs slowly	Excess salt, excess sodium.
NxD*:						
Nunn	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Nihill	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
OrE*:						
Orella	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, percs slowly.	Slope, depth to rock, percs slowly.	Slope, droughty, depth to rock.
Rock outcrop.						
PcB, PcC Pierre	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
PhB*:						
Pierre	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
PkD*:						
Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
PrA Promise	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.
PsA*:						
Promise	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.
Hurley	Slight	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily	Excess sodium, erodes easily.
PsB*:						
Promise	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PsB*: Hurley	Moderate: slope.	Severe: hard to pack, excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily	Excess sodium, erodes easily.
PuB*, PuC*: Promise	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, droughty.	Percs slowly, erodes easily.	Erodes easily, droughty.
Pierre	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
RhC*: Razor	Severe: slope.	Severe: excess salt.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
RmD*: Razor	Severe: slope.	Severe: excess salt.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
SaF: Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
ShE*: Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Hisle	Severe: slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, excess sodium, erodes easily.
Rock outcrop.						
SpE*: Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SrF*: Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
SrF*: Rock outcrop.						
SwB*:						
Savo	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
Dawes	Moderate: seepage.	Severe: thin layer.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
VwC*:						
Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Wortman	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Droughty, fast intake, soil blowing.	Depth to rock, soil blowing.	Excess sodium, droughty.
Wb Wendte	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
Wc Wendte	Slight	Severe: hard to pack.	Deep to water	Flooding, percs slowly, slow intake.	Percs slowly	Percs slowly.
WeA Weta	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly	Erodes easily	Erodes easily, percs slowly.
WhA Whitewater	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
WsC*:						
Wortman	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Droughty, fast intake, soil blowing.	Depth to rock, soil blowing.	Excess sodium, droughty.
Hisle	Moderate: depth to rock, slope.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ab----------	0-3	Silt loam--------	ML	A-4	0-5	85-100	85-100	75-95	50-65	15-20	NP-5
Absted	3-29	Silty clay, silty clay loam.	CL	A-6	0	85-100	85-100	80-100	75-95	30-40	10-20
	29-60	Clay, clay loam, silty clay loam.	CH, CL	A-7	0	85-100	85-100	80-100	70-95	40-60	20-30
Ar----------	0-2	Loam----------	CL-ML, CL	A-4, A-6	0	80-100	75-100	70-100	50-85	20-30	5-15
Arvada	2-12	Clay, clay loam, silty clay loam.	CH, CL	A-7, A-6	0	95-100	75-100	75-100	60-95	35-60	15-40
	12-60	Clay, clay loam, silty clay.	CL	A-6, A-7	0	85-100	80-100	70-95	60-90	25-50	10-25
As*:											
Arvada----------	0-2	Loam----------	CL-ML, CL	A-4, A-6	0	80-100	75-100	70-100	50-85	20-30	5-15
	2-12	Clay, clay loam, silty clay loam.	CH, CL	A-7, A-6	0	95-100	75-100	75-100	60-95	35-60	15-40
	12-60	Clay, clay loam, silty clay.	CL	A-6, A-7	0	85-100	80-100	70-95	60-90	25-50	10-25
Slickspots.											
Ba*.											
Badland											
BcB----------	0-6	Loam----------	CL-ML, SM-SC, ML, SM	A-4	0	80-100	75-95	50-80	40-60	20-30	NP-10
Beckton	6-8	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	8-20	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	20-47	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	47-60	Clay loam, clay, loam.	CL	A-6, A-7	0	80-100	75-95	65-90	60-85	30-50	10-30
BdA*:											
Beckton----------	0-6	Loam----------	CL-ML, SM-SC, ML, SM	A-4	0	80-100	75-95	50-80	40-60	20-30	NP-10
	6-8	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	8-20	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	20-47	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	47-60	Clay loam, clay, loam.	CL	A-6, A-7	0	80-100	75-95	65-90	60-85	30-50	10-30
Arvada----------	0-2	Loam----------	CL-ML	A-4	0	95-100	95-100	85-95	70-80	15-25	5-10
	2-12	Clay, silty clay loam, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-65	20-35
	12-60	Clay loam, silty clay loam, clay.	CL	A-7	0	80-100	75-100	70-100	55-90	40-45	20-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BwC*:											
Blackpipe-------	0-4	Silt loam---------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	4-17	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-30
	17-37	Silty clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	75-100	30-50	10-26
	37-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wortman---------	0-5	Silt loam---------	CL, ML	A-4, A-6	0	100	95-100	85-100	60-95	30-40	5-15
	5-20	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	100	95-100	90-100	70-95	40-75	15-45
	20-31	Loam, silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-95	60-80	30-45	5-20
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CaA---------- Cactusflat	0-4	Silty clay--------	CL, CH	A-7	0	100	100	95-100	80-100	45-65	20-35
	4-19	Silty clay, clay	CH	A-7	0	100	100	95-100	85-100	50-70	25-40
	19-25	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	45-65	20-35
	25-60	Stratified fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-100	35-50	15-30
CbB*:											
Cactusflat------	0-4	Silty clay--------	CL, CH	A-7	0	100	100	95-100	80-100	45-65	20-35
	4-19	Silty clay, clay	CH	A-7	0	100	100	95-100	85-100	50-70	25-40
	19-25	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	45-65	20-35
	25-60	Stratified fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-100	35-50	15-30
Weta----------	0-2	Silt loam---------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	2-11	Clay, clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	11-30	Silty clay loam, silty clay, clay loam.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	30-60	Stratified very fine sandy loam to clay.	CL, CH	A-7	0	100	100	80-100	70-95	40-60	20-40
CeA---------- Cedarpass	0-3	Silt loam---------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	70-95	30-45	8-20
	3-17	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-100	35-45	10-20
	17-45	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	45-51	Loam, silty clay loam, clay loam.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CfA*:											
Cedarpass	0-3	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	70-95	30-45	8-20
	3-17	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	17-45	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	45-51	Loam, silty clay loam, clay loam.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
Denby	0-5	Silty clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	5-27	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	27-60	Stratified silt loam to clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
CoD	0-6	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Colby	6-60	Silt loam, loam, silty clay loam.	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Cv*:											
Craft	0-6	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	50-98	<25	NP-15
	6-42	Stratified loamy very fine sand to silty clay loam.	ML, CL-ML, CL	A-4, A-6,	0	95-100	95-100	85-100	55-90	20-35	NP-15
	42-60	Fine sand	SM	A-2	0	85-100	90-100	65-80	20-35	<25	NP
Bankard Variant	0-6	Very fine sandy loam.	ML, SM, SM-SC, CL-ML	A-4	0	95-100	95-100	65-90	40-80	<25	NP-6
	6-29	Stratified very fine sand to silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	95-100	90-100	65-85	40-80	<25	NP-5
	29-60	Gravelly sand, very gravelly sand.	GM, SM, GP-GM, SP-SM	A-1, A-2, A-3	0-5	35-75	35-75	20-60	5-20	<25	NP-5
EaB	0-3	Loam	CL	A-6	0	100	100	85-95	60-75	25-30	10-15
Emigrant	3-16	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	16-30	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
EbA*:											
Emigrant	0-3	Loam	CL	A-6	0	100	100	85-95	60-75	25-30	10-15
	3-16	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	16-30	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Beckton Variant	0-8	Loam	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	25-45	5-20
	8-16	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-95	40-65	15-35
	16-32	Clay loam, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-60	10-35
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EbC*:											
Emigrant--------	0-3	Loam----------	CL	A-6	0	100	100	85-95	60-75	25-30	10-15
	3-16	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	16-30	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Beckton Variant-	0-8	Silt loam--------	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	25-45	5-20
	8-16	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-95	40-65	15-35
	16-32	Clay loam, clay, silty clay loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-95	35-60	10-35
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
EcD*:											
Emigrant--------	0-3	Loam----------	CL	A-6	0	100	100	85-95	60-75	25-30	10-15
	3-16	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	16-30	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Conata----------	0-6	Clay----------	CH	A-7	0	95-100	95-100	90-100	80-100	50-75	25-45
	6-18	Clay, silty clay	CH	A-7	0	95-100	95-100	90-100	75-100	50-75	25-45
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ErB*, ErC*, ErD*:											
Emigrant--------	0-3	Loam----------	CL	A-6	0	100	100	85-95	60-75	25-30	10-15
	3-16	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	16-30	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	70-90	40-60	20-30
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Razor----------	0-3	Silty clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	3-16	Silty clay, clay, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	16-33	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Fv*. Fluvaquents											
Ha---------- Haverson	0-7	Loam----------	ML	A-4	0	95-100	90-100	85-100	55-90	25-35	NP-10
	7-60	Stratified clay loam to gravelly sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15
Hc*:											
Haverson--------	0-7	Loam----------	ML	A-4	0	95-100	90-100	85-100	55-90	25-35	NP-10
	7-60	Stratified clay loam to gravelly sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15
Craft----------	0-6	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	50-98	<25	NP-15
	6-42	Stratified loamy very fine sand to silty clay loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	55-90	20-35	NP-15
	42-60	Very fine sandy loam, silt loam, loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	50-98	<25	NP-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ho	0-5	Silty clay	CL, CH, MH	A-7	0	100	95-100	95-100	80-100	40-60	15-30
Hilmoe	5-25	Stratified silty clay loam to clay.	CL, CH, MH	A-7	0	100	95-100	95-100	80-100	40-65	15-35
	25-60	Stratified very fine sandy loam to clay loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	55-80	25-40	5-15
HpC	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Hisle	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
HrC*:											
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
Rock outcrop.											
HsC*:											
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
Slickspots.											
Hu	0-2	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Hurley	2-60	Clay, shaly clay	CH, MH	A-7	0	100	100	85-100	80-100	60-90	30-50
In, Io	0-4	Loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
Interior	4-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
IsB*:											
Interior	0-4	Loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	4-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
Cedarpass	0-3	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	70-95	30-45	8-20
	3-17	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	17-45	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	45-51	Loam, silty clay loam, clay loam.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
Badland.											

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Iv*:											
Interior	0-4	Loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	4-60	Stratified very fine sandy loam to clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
Denby	0-5	Silty clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	5-27	Silty clay, clay	CH	A-7	0	100	100	95-100	80-100	50-85	25-50
	27-60	Stratified silt loam to clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-50	15-30
Cedarpass	0-3	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	70-95	30-45	8-20
	3-17	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	100	100	90-100	80-100	35-45	10-20
	17-45	Stratified very fine sandy loam to silty clay loam.	ML, CL	A-6, A-7	0	100	100	85-100	80-100	30-50	10-20
	45-51	Loam, silty clay loam, clay loam.	CL, CH	A-7	0	100	95-100	95-100	80-100	45-75	20-45
	51-60	Stratified very fine sandy loam to silty clay loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
Ko	0-16	Clay	CH, MH	A-7	0	100	100	95-100	85-100	50-90	25-50
Kolls	16-60	Clay	CH, MH	A-7	0	100	100	95-100	85-100	60-90	25-55
KyA	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
Kyle	4-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
KyB	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
Kyle	4-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
KyC	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
Kyle	4-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
LcD*:											
Larvie	0-5	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-45
	5-12	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-95	35-45
	12-26	Clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Conata	0-6	Clay	CH	A-7	0	95-100	95-100	90-100	80-100	50-75	25-45
	6-18	Clay, silty clay	CH	A-7	0	95-100	95-100	90-100	75-100	50-75	25-45
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
LhC*:											
Larvie	0-5	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-45
	5-12	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-95	35-45
	12-26	Clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-31	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	31-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Lo	0-6	Silty clay	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
Lohmiller	6-60	Stratified fine sandy loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	65-95	35-60	12-30
MhA*, MhB*:											
Metre	0-4	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-40
	4-19	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-85	35-45
	19-37	Silty clay, clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	37-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
MoB*:											
Metre	0-4	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-40
	4-19	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-85	35-45
	19-37	Silty clay, clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	37-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Larvie	0-5	Clay	CH, MH	A-7	0	100	100	95-100	85-100	55-80	30-45
	5-12	Clay	CH, MH	A-7	0	100	95-100	95-100	85-100	65-95	35-45
	12-26	Clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
MyE	0-6	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
Midway	6-14	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	20-35
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
NkD*:											
Nihill	0-9	Gravelly loam	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	9-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM-GC, GC	A-2	0-15	30-60	20-50	15-40	10-35	25-40	5-15
Samsil	0-3	Clay	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	3-11	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	11-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
NoA	0-5	Silt loam	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
Norka	5-11	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	11-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	95-100	75-95	20-30	NP-10
NpD*:											
Norka	0-5	Silt loam	ML, CL-ML, CL	A-4	0	100	95-100	85-95	60-85	20-35	2-10
	5-11	Silty clay loam, loam, clay loam.	CL	A-6	0	100	95-100	95-100	85-95	25-40	10-20
	11-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	95-100	75-95	20-30	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NpD*:											
Colby----------	0-6	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	6-60	Silt loam, loam, silty clay loam.	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
NrC*:											
Norrest---------	0-4	Silt loam--------	ML, CL	A-6, A-7	0	100	100	90-100	70-100	35-45	10-20
	4-28	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wanblee---------	0-2	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	60-95	25-40	3-15
	2-12	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-85	40-70	15-45
	12-29	Clay loam, loam	CL	A-6, A-7	0	100	95-100	90-100	65-85	35-50	15-30
	29-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
NuA, NuB, NuC----	0-11	Loam-------------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
Nunn	11-42	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	42-60	Clay loam, loam, sandy clay loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
NuD----------	0-9	Loam-------------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
Nunn	9-21	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	21-60	Clay loam, loam, sandy clay loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
NwB*:											
Nunn----------	0-11	Loam-------------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	11-42	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	42-60	Clay loam, loam, sandy clay loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
Beckton---------	0-6	Loam-------------	CL-ML, SM-SC, ML, SM	A-4	0	80-100	75-95	50-80	40-60	20-30	NP-10
	6-8	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	8-20	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	20-47	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	47-60	Clay loam, clay, loam.	CL	A-6, A-7	0	80-100	75-95	65-90	60-85	30-50	10-30
NxD*:											
Nunn----------	0-11	Loam-------------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	11-42	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	42-60	Clay loam, loam, sandy clay loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
Nihill----------	0-9	Gravelly loam----	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	9-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM-GC, GC	A-2	0-15	30-60	20-50	15-40	10-35	25-40	5-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
OrE*:											
Orella	0-3	Clay loam	CH, CL	A-6, A-7	0	100	100	95-100	70-95	38-65	20-40
	3-14	Clay, clay loam	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
PcB, PcC	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
Pierre	4-26	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	26-37	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	37-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
PhB*:											
Pierre	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-26	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	26-37	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	37-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
PkD*:											
Pierre	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-20	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	20-37	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	37-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
Samsil	0-3	Clay	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	3-11	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	11-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
PrA	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-70	25-40
Promise	5-26	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	26-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
PsA*, PsB*:											
Promise	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-70	25-40
	5-26	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	26-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
Hurley	0-2	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-60	Clay, shaly clay	CH, MH	A-7	0	100	100	85-100	80-100	60-90	30-50
PuB*, PuC*:											
Promise	0-5	Clay	CH, MH	A-7	0	100	100	90-100	80-100	55-70	25-40
	5-26	Clay	CH, MH	A-7	0	100	100	90-100	85-100	60-85	25-50
	26-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	60-90	25-55
Pierre	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-26	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	26-37	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	37-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
RhC*:											
Razor	0-3	Silty clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	3-16	Silty clay, clay, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	16-33	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RhC*:											
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
RmD*:											
Razor	0-3	Silty clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	3-16	Silty clay, clay, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	16-33	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway	0-6	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	6-14	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SaF	0-3	Clay	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
Samsil	3-11	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	11-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
ShE*:											
Samsil	0-3	Clay	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	3-11	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	11-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
Rock outcrop.											
SpE*:											
Samsil	0-3	Clay	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	3-11	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	11-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Pierre	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-26	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	26-37	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	37-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
SrF*:											
Samsil	0-3	Clay	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	3-11	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	11-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Rock outcrop.											
SwB*:											
Savo	0-5	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	5-20
	5-22	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	22-42	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	100	95-100	90-100	85-95	40-55	15-30
	42-60	Silty clay loam, silt loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-100	35-55	12-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SwB*:											
Dawes	0-10	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	95-100	85-90	20-40	3-18
	10-17	Silty clay, silty clay loam.	CH	A-7	0	100	95-100	95-100	85-95	50-65	30-45
	17-60	Silt loam, silty clay loam, loam.	CL	A-6	0	100	95-100	85-100	60-95	25-40	10-20
VwC*:											
Valent	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	---	NP
	5-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
Wortman	0-10	Loamy fine sand	SM	A-2	0	100	100	65-95	10-30	<25	NP-5
	10-19	Sandy clay, clay	CL, CH	A-7	0	100	100	85-100	55-95	40-70	15-40
	19-36	Clay, clay loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	90-100	70-95	40-75	15-45
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wb	0-8	Clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-45
Wendte	8-60	Stratified silty clay loam to clay.	CH, MH	A-7	0	100	100	90-100	70-100	50-80	20-45
Wc	0-8	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
Wendte	8-60	Stratified silty clay loam to clay.	CH, MH	A-7	0	100	100	90-100	70-100	50-80	20-45
WeA	0-2	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
Weta	2-11	Clay, clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	11-30	Silty clay loam, silty clay, clay loam.	CH, CL	A-7	0	100	100	90-100	80-100	45-65	20-35
	30-60	Stratified very fine sandy loam to clay.	CL, CH	A-7	0	100	100	80-100	70-95	40-60	20-40
WhA	0-3	Clay	CH, MH	A-7	0	100	95-100	95-100	80-100	60-85	30-45
Whitewater	3-21	Clay	CH	A-7	0	100	95-100	95-100	80-100	70-100	40-65
	21-28	Clay	CH	A-7	0	100	95-100	95-100	80-100	70-100	40-65
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WsC*:											
Wortman	0-10	Loamy fine sand	SM	A-2	0	100	100	65-95	10-30	<25	NP-5
	10-19	Sandy clay, clay	CL, CH	A-7	0	100	100	85-100	55-95	40-70	15-40
	19-36	Clay, clay loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	90-100	70-95	40-75	[illegible]-45
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hisle	0-1	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-	5-15
	1-26	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45	20-55
	26-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50 0	30-60

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
Ab----------	0-3	0.6-2.0	0.15-0.17	6.6-7.8	<2	Low---------	0.32	5	5	1-2
Absted	3-29	0.06-0.2	0.16-0.20	>7.8	2-8	High--------	0.43			
	29-60	0.06-0.2	0.11-0.13	>7.8	>16	High--------	0.55			
Ar----------	0-2	0.2-2.0	0.07-0.12	>7.8	<4	Low---------	0.32	1	6	1-3
Arvada	2-12	<0.06	0.07-0.12	>8.4	>4	High--------	0.37			
	12-60	0.2-0.6	0.07-0.12	>7.8	>4	High--------	0.37			
As*:										
Arvada----------	0-2	0.2-2.0	0.07-0.12	>7.8	<4	Low---------	0.32	1	6	1-3
	2-12	<0.06	0.07-0.12	>8.4	>4	High--------	0.37			
	12-60	0.2-0.6	0.07-0.12	>7.8	>4	High--------	0.37			
Slickspots.										
Ba*.										
Badland										
BcB----------	0-6	0.6-2.0	0.10-0.13	6.1-8.4	<8	Low---------	0.28	3	6	1-3
Beckton	6-8	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low---------	0.20			
	8-20	0.06-0.2	0.12-0.15	7.4-9.0	>4	High--------	0.28			
	20-47	<0.06	0.09-0.12	8.5-9.0	>4	High--------	0.28			
	47-60	0.06-0.6	0.10-0.13	>7.8	>4	High--------	0.28			
BdA*:										
Beckton---------	0-6	0.6-2.0	0.10-0.13	6.1-8.4	<8	Low---------	0.28	3	6	1-3
	6-8	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low---------	0.20			
	8-20	0.06-0.2	0.12-0.15	7.4-9.0	>4	High--------	0.28			
	20-47	<0.06	0.09-0.12	8.5-9.0	>4	High--------	0.28			
	47-60	0.06-0.6	0.10-0.13	>7.8	>4	High--------	0.28			
Arvada----------	0-2	0.6-2.0	0.07-0.12	>7.8	<4	Low---------	0.32	1	6	.5-1
	2-12	<0.06	0.07-0.12	>8.4	>4	High--------	0.32			
	12-60	0.06-0.2	0.07-0.12	>7.8	>4	High--------	0.32			
BwC*:										
Blackpipe-------	0-4	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate----	0.32	4	6	2-4
	4-17	0.2-0.6	0.11-0.19	6.6-7.8	<2	High--------	0.32			
	17-37	0.2-0.6	0.13-0.20	7.4-8.4	<2	Moderate----	0.32			
	37-60	---	---	---	---	----------	----			
Wortman---------	0-5	0.6-2.0	0.18-0.22	6.1-7.8	<2	Low---------	0.32	3	6	2-4
	5-20	<0.06	0.08-0.14	6.6-8.4	4-16	High--------	0.32			
	20-31	0.2-0.6	0.13-0.15	7.4-9.0	2-16	Moderate----	0.32			
	31-60	---	---	---	---	----------	----			
CaA----------	0-4	0.06-0.2	0.10-0.14	6.6-8.4	<2	High--------	0.32	5	4	2-4
Cactusflat	4-19	0.06-0.2	0.08-0.13	7.4-8.4	<4	Very high	0.32			
	19-25	0.06-0.2	0.10-0.17	7.4-8.4	<8	High--------	0.32			
	25-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate----	0.32			
CbB*:										
Cactusflat------	0-4	0.06-0.2	0.10-0.14	6.6-8.4	<2	High--------	0.32	5	4	2-4
	4-19	0.06-0.2	0.08-0.13	7.4-8.4	<4	Very high	0.32			
	19-25	0.06-0.2	0.10-0.17	7.4-8.4	<8	High--------	0.32			
	25-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate----	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
CbB*:										
Weta----------	0-2	0.6-2.0	0.16-0.19	5.1-7.8	<2	Low---------	0.32	1	6	1-3
	2-11	<0.2	0.10-0.16	6.6-8.4	<4	High--------	0.32			
	11-30	0.06-0.6	0.08-0.14	7.4-9.0	2-8	Moderate----	0.32			
	30-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate----	0.43			
CeA----------	0-3	0.6-2.0	0.14-0.19	6.1-7.8	<4	Low---------	0.32	5	4L	1-3
Cedarpass	3-17	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate----	0.43			
	17-45	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low---------	0.43			
	45-51	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate----	0.43			
	51-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Low---------	0.43			
CfA*:										
Cedarpass-------	0-3	0.6-2.0	0.14-0.19	6.1-7.8	<4	Low---------	0.32	5	4L	1-3
	3-17	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate----	0.43			
	17-45	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low---------	0.43			
	45-51	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate----	0.43			
	51-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Low---------	0.43			
Denby----------	0-5	0.06-0.2	0.08-0.12	6.6-8.4	<4	High--------	0.32	5	4	1-3
	5-27	0.06-0.2	0.08-0.12	7.4-8.4	<4	High--------	0.32			
	27-60	0.2-2.0	0.14-0.17	7.4-9.0	<4	Moderate----	0.32			
CoD----------	0-6	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low---------	0.43	5	4L	.5-2
Colby	6-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low---------	0.43			
Cv*:										
Craft----------	0-6	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low---------	0.37	5	4L	.5-2
	6-42	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low---------	0.43			
	42-60	2.0-6.0	0.17-0.19	7.4-8.4	<2	Low---------	0.43			
Bankard Variant-	0-6	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low---------	0.37	4	3	.5-2
	6-29	6.0-20	0.08-0.10	7.4-8.4	<2	Low---------	0.15			
	29-60	>20	0.03-0.06	7.4-8.4	<2	Low---------	0.10			
EaB----------	0-3	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	4	6	2-4
Emigrant	3-16	0.2-0.6	0.15-0.17	6.6-8.4	<2	High--------	0.24			
	16-30	0.2-0.6	0.15-0.17	7.9-8.4	<2	High--------	0.24			
	30-60	---	---	---	---	----------	----			
EbA*, EbC*:										
Emigrant--------	0-3	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	4	6	2-4
	3-16	0.2-0.6	0.15-0.17	6.6-8.4	<2	High--------	0.24			
	16-30	0.2-0.6	0.15-0.17	7.9-8.4	<2	High--------	0.24			
	30-60	---	---	---	---	----------	----			
Beckton Variant-	0-8	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate----	0.32	3	6	1-3
	8-16	<0.06	0.10-0.19	6.6-8.4	<4	High--------	0.32			
	16-32	0.06-0.2	0.08-0.17	7.4-9.0	4-16	High--------	0.32			
	32-60	---	---	6.6-8.4	---	----------	----			
EcD*:										
Emigrant--------	0-3	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	4	6	2-4
	3-16	0.2-0.6	0.15-0.17	6.6-8.4	<2	High--------	0.24			
	16-30	0.2-0.6	0.15-0.17	7.9-8.4	<2	High--------	0.24			
	30-60	---	---	---	---	----------	----			
Conata----------	0-6	<0.06	0.08-0.14	6.6-7.8	<2	Very high	0.37	2	4	1-3
	6-18	<0.06	0.08-0.14	7.4-8.4	<4	Very high	0.37			
	18-60	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
ErB*, ErC*, ErD*:										
Emigrant--------	0-3	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate----	0.28	4	6	2-4
	3-16	0.2-0.6	0.15-0.17	6.6-8.4	<2	High--------	0.24			
	16-30	0.2-0.6	0.15-0.17	7.9-8.4	<2	High--------	0.24			
	30-60	---	---	---	---	----------	----			
Razor-----------	0-3	0.06-0.2	0.15-0.18	6.6-8.4	<2	High--------	0.32	4	4	.5-2
	3-16	0.06-0.2	0.15-0.18	7.4-8.4	<2	High--------	0.28			
	16-33	0.06-0.2	0.15-0.18	7.4-8.4	>8	High--------	0.28			
	33-60	---	---	---	---	----------	----			
Fv*.										
Fluvaquents										
Ha---------------	0-7	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low---------	0.28	5	4L	1-3
Haverson	7-60	0.6-2.0	0.14-0.18	7.4-9.0	2-4	Low---------	0.28			
Hc*:										
Haverson--------	0-7	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low---------	0.28	5	4L	1-3
	7-60	0.6-2.0	0.14-0.18	7.4-9.0	2-4	Low---------	0.28			
Craft-----------	0-6	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low---------	0.37	5	4L	.5-2
	6-42	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low---------	0.43			
	42-60	2.0-6.0	0.17-0.19	7.4-8.4	<2	Low---------	0.43			
Ho---------------	0-5	0.06-0.2	0.19-0.22	7.4-8.4	<2	High--------	0.37	5	4	2-4
Hilmoe	5-25	0.06-0.2	0.17-0.20	7.4-8.4	<2	High--------	0.37			
	25-60	0.2-2.0	0.16-0.20	7.4-8.4	<4	Moderate----	0.28			
HpC--------------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low---------	0.28	1	6	1-3
Hisle	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	----------	----			
HrC*:										
Hisle-----------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low---------	0.28	1	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	----------	----			
Rock outcrop.										
HsC*:										
Hisle-----------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low---------	0.28	1	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	----------	----			
Slickspots.										
Hu---------------	0-2	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.43	1	6	1-2
Hurley	2-60	<0.06	0.05-0.13	7.4-9.0	4-16	Very high	0.43			
In, Io-----------	0-4	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low---------	0.32	5	4L	<1
Interior	4-60	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low---------	0.43			
IsB*:										
Interior--------	0-4	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low---------	0.32	5	4L	<1
	4-60	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low---------	0.43			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
IsB*:										
Cedarpass-------	0-3	0.6-2.0	0.14-0.19	6.1-7.8	<4	Low---------	0.32	5	4L	1-3
	3-17	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate----	0.43			
	17-45	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low---------	0.43			
	45-51	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate----	0.43			
	51-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Low---------	0.43			
Badland.										
Iv*:										
Interior--------	0-4	0.6-2.0	0.16-0.19	7.4-9.0	<2	Low---------	0.32	5	4L	<1
	4-60	0.2-2.0	0.14-0.17	7.9-9.0	<4	Low---------	0.43			
Denby-----------	0-5	0.06-0.2	0.08-0.12	6.6-8.4	<4	High--------	0.32	5	4	1-3
	5-27	0.06-0.2	0.08-0.12	7.4-8.4	<4	High--------	0.32			
	27-60	0.2-2.0	0.14-0.17	7.4-9.0	<4	Moderate----	0.32			
Cedarpass-------	0-3	0.6-2.0	0.14-0.19	6.1-7.8	<4	Low---------	0.32	5	4L	1-3
	3-17	0.2-2.0	0.14-0.17	6.6-8.4	<4	Moderate----	0.43			
	17-45	0.2-2.0	0.14-0.17	7.4-9.0	<4	Low---------	0.43			
	45-51	0.2-0.6	0.13-0.17	7.4-9.0	<4	Moderate----	0.43			
	51-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Low---------	0.43			
Ko---------------	0-16	<0.06	0.10-0.14	7.4-8.4	<2	Very high	0.37	5	4	2-4
Kolls	16-60	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
KyA--------------	0-4	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
Kyle	4-60	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
KyB--------------	0-4	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
Kyle	4-60	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
KyC--------------	0-4	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
Kyle	4-60	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
LcD*:										
Larvie----------	0-5	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	4	4	1-3
	5-12	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	12-26	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	26-60	---	---	---	---	----------	----			
Conata----------	0-6	<0.06	0.08-0.14	6.6-7.8	<2	Very high	0.37	2	4	1-3
	6-18	<0.06	0.08-0.14	7.4-8.4	<4	Very high	0.37			
	18-60	---	---	---	---	----------	----			
LhC*:										
Larvie----------	0-5	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	4	4	1-3
	5-12	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	12-26	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	26-60	---	---	---	---	----------	----			
Hisle-----------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low---------	0.28	3	6	1-3
	1-31	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	31-60	---	---	6.1-8.4	---	----------	----			
Lo---------------	0-6	0.06-0.6	0.11-0.16	6.6-8.4	<4	High--------	0.32	5	4	1-3
Lohmiller	6-60	0.06-0.6	0.14-0.16	7.4-8.4	<8	High--------	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
MhA*, MhB*:										
Metre	0-4	<0.06	0.10-0.14	7.4-8.4	<2	Very high	0.37	4	4	2-4
	4-19	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	19-37	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	37-60	---	---	---	---	---	---			
Hisle	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low	0.28	3	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	---	---			
MoB*:										
Metre	0-4	<0.06	0.10-0.14	7.4-8.4	<2	Very high	0.37	4	4	2-4
	4-19	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	19-37	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	37-60	---	---	---	---	---	---			
Larvie	0-5	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37	4	4	1-3
	5-12	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	12-26	<0.06	0.08-0.12	7.4-8.4	<8	Very high	0.37			
	26-60	---	---	---	---	---	---			
MyE	0-6	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.37	2	4L	.5-2
Midway	6-14	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	14-60	---	---	---	---	---	---			
NkD*:										
Nihill	0-9	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low	0.24	5	6	.5-1
	9-60	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low	0.05			
Samsil	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	11-60	---	---	---	---	---	---			
NoA	0-5	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low	0.32	5	6	2-4
Norka	5-11	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	11-60	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low	0.32			
NpD*:										
Norka	0-5	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low	0.32	5	6	2-4
	5-11	0.2-0.6	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	11-60	0.6-2.0	0.16-0.21	7.4-8.4	<2	Low	0.32			
Colby	0-6	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.43	5	4L	.5-2
	6-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
NrC*:										
Norrest	0-4	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37	4	4L	1-3
	4-28	0.2-0.6	0.11-0.17	7.4-8.4	<2	High	0.37			
	28-60	---	---	---	---	---	---			
Wanblee	0-2	0.6-2.0	0.19-0.22	5.6-7.3	<2	Low	0.32	3	6	1-3
	2-12	<0.06	0.10-0.16	6.6-7.8	2-16	High	0.32			
	12-29	0.2-0.6	0.13-0.17	7.9-9.0	4-16	Moderate	0.32			
	29-60	---	---	7.9-9.0	<4	---	---			
NuA, NuB, NuC	0-11	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate	0.28	5	6	2-4
Nunn	11-42	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.28			
	42-60	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate	0.24			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
NuD----------	0-9	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate----	0.28	5	6	2-4
Nunn	9-21	0.06-0.2	0.15-0.18	6.6-8.4	<2	High--------	0.28			
	21-60	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate----	0.24			
NwB*:										
Nunn----------	0-11	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate----	0.28	5	6	2-4
	11-42	0.06-0.2	0.15-0.18	6.6-8.4	<2	High--------	0.28			
	42-60	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate----	0.24			
Beckton---------	0-6	0.6-2.0	0.10-0.13	6.1-8.4	<8	Low---------	0.28	3	6	1-3
	6-8	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low---------	0.20			
	8-20	0.06-0.2	0.12-0.15	7.4-9.0	>4	High--------	0.28			
	20-47	<0.06	0.09-0.12	8.5-9.0	>4	High--------	0.28			
	47-60	0.06-0.6	0.10-0.13	>7.8	>4	High--------	0.28			
NxD*:										
Nunn----------	0-11	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate----	0.28	5	6	2-4
	11-42	0.06-0.2	0.15-0.18	6.6-8.4	<2	High--------	0.28			
	42-60	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate----	0.24			
Nihill----------	0-9	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low---------	0.24	5	6	.5-1
	9-60	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low---------	0.05			
OrE*:										
Orella----------	0-3	0.2-0.6	0.12-0.14	7.4-8.4	<4	High--------	0.32	2	4	.5-1
	3-14	<0.06	0.09-0.11	7.4-9.0	4-16	High--------	0.32			
	14-60	---	---	---	---	----------	----			
Rock outcrop.										
PcB, PcC---------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
Pierre	4-26	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	26-37	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	37-60	---	---	---	<2	----------	----			
PhB*:										
Pierre----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-26	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	26-37	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	37-60	---	---	---	<2	----------	----			
Hisle----------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low---------	0.28	3	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	----------	----			
PkD*:										
Pierre----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-20	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	20-37	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	37-60	---	---	---	<2	----------	----			
Samsil----------	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	11-60	---	---	---	---	----------	----			
PrA----------	0-5	<0.2	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4	2-4
Promise	5-26	<0.2	0.08-0.14	7.4-9.0	<2	Very high	0.37			
	26-60	<0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
PsA*, PsB*:										
Promise	0-5	<0.2	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4	2-4
	5-26	<0.2	0.08-0.14	7.4-9.0	<2	Very high	0.37			
	26-60	<0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
Hurley	0-2	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.43	3	6	1-2
	2-60	<0.06	0.05-0.13	7.4-9.0	4-16	Very high	0.43			
PuB*, PuC*:										
Promise	0-5	<0.2	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4	2-4
	5-26	<0.2	0.08-0.14	7.4-9.0	<2	Very high	0.37			
	26-60	<0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37			
Pierre	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-26	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	26-37	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	37-60	---	---	---	<2	---	---			
RhC*:										
Razor	0-3	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.32	4	4	.5-2
	3-16	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	16-33	0.06-0.2	0.15-0.18	7.4-8.4	>8	High	0.28			
	33-60	---	---	---	---	---	---			
Hisle	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low	0.28	3	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	---	---			
RmD*:										
Razor	0-3	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.32	4	4	.5-2
	3-16	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	16-33	0.06-0.2	0.15-0.18	7.4-8.4	>8	High	0.28			
	33-60	---	---	---	---	---	---			
Midway	0-6	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.37	2	4	.5-2
	6-14	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	14-60	---	---	---	---	---	---			
SaF	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
Samsil	3-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	11-60	---	---	---	---	---	---			
ShE*:										
Samsil	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	11-60	---	---	---	---	---	---			
Hisle	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low	0.28	3	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	---	---			
Rock outcrop.										
SpE*:										
Samsil	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	11-60	---	---	---	---	---	---			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
SpE*:										
Pierre----------	0-4	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-26	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	26-37	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	37-60	---	---	---	<2	----------	----			
SrF*:										
Samsil----------	0-3	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	3-11	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	11-60	---	---	---	---	----------	----			
Rock outcrop.										
SwB*:										
Savo----------	0-5	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	2-4
	5-22	0.2-0.6	0.11-0.19	6.1-7.8	<2	High--------	0.43			
	22-42	0.2-0.6	0.11-0.19	7.4-8.4	<2	High--------	0.43			
	42-60	0.2-2.0	0.11-0.17	7.4-8.4	<2	Moderate----	0.43			
Dawes----------	0-10	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low---------	0.37	4	6	2-4
	10-17	0.06-2.0	0.11-0.13	7.4-8.4	<2	High--------	0.37			
	17-60	0.6-2.0	0.20-0.22	8.5-9.0	<2	Moderate----	0.37			
VwC*:										
Valent----------	0-5	6.0-20	0.07-0.12	6.6-7.8	<2	Low---------	0.17	5	2	.5-1
	5-60	6.0-20	0.05-0.10	6.6-7.8	<2	Low---------	0.10			
Wortman---------	0-10	6.0-20	0.07-0.12	5.6-7.3	<2	Low---------	0.17	3	2	1-3
	10-19	<0.06	0.11-0.16	6.1-7.8	<2	High--------	0.32			
	19-36	0.06-0.6	0.11-0.20	7.4-9.0	<4	High--------	0.32			
	36-60	---	---	---	---	----------	----			
Wb----------	0-8	0.06-0.2	0.13-0.18	7.4-8.4	<2	High--------	0.38	5	4	2-4
Wendte	8-60	0.06-0.2	0.11-0.17	7.4-8.4	<2	High--------	0.38			
Wc----------	0-8	0.06-0.2	0.13-0.18	7.4-8.4	<2	High--------	0.38	5	4	3-5
Wendte	8-60	0.06-0.2	0.11-0.17	7.4-8.4	<2	High--------	0.38			
WeA----------	0-2	0.6-2.0	0.16-0.19	5.1-7.8	<2	Low---------	0.32	3	6	1-3
Weta	2-11	<0.2	0.10-0.16	6.6-8.4	<4	High--------	0.32			
	11-30	0.06-0.6	0.08-0.14	7.4-9.0	2-8	Moderate----	0.32			
	30-60	0.2-2.0	0.14-0.17	7.4-9.0	<8	Moderate----	0.43			
WhA----------	0-3	<0.06	0.05-0.08	7.4-9.0	<2	Very high	0.37	4	4	1-2
Whitewater	3-21	<0.06	0.05-0.08	7.4-9.0	<2	Very high	0.37			
	21-28	<0.06	0.05-0.08	7.4-9.0	2-4	Very high	0.37			
	28-60	---	---	---	---	----------	----			
WsC*:										
Wortman---------	0-10	6.0-20	0.07-0.12	5.6-7.3	<2	Low---------	0.17	3	2	1-3
	10-19	<0.06	0.11-0.16	6.1-7.8	<2	High--------	0.32			
	19-36	0.06-0.6	0.11-0.20	7.4-9.0	<4	High--------	0.32			
	36-60	---	---	---	---	----------	----			
Hisle----------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low---------	0.28	3	6	1-3
	1-26	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	26-60	---	---	6.1-8.4	---	----------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ab---------- Absted	D	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	High.
Ar---------- Arvada	D	Rare--------	---	---	>6.0	---	---	>60	---	Low-------	High------	High.
As*: Arvada---------	D	Rare--------	---	---	>6.0	---	---	>60	---	Low-------	High------	High.
Slickspots.												
Ba*. Badland												
BcB---------- Beckton	D	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	High.
BdA*: Beckton--------	D	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	High.
Arvada---------	D	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
BwC*: Blackpipe------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.
Wortman--------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
CaA---------- Cactusflat	C	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
CbB*: Cactusflat-----	C	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Weta----------	D	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
CeA---------- Cedarpass	B	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
CfA*: Cedarpass------	B	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Denby----------	C	None--------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
CoD---------- Colby	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Cv*:												
Craft----------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Bankard Variant	A	Occasional	Brief-----	May-Sep	>6.0	---	---	>60	---	Low------	Moderate	Low.
EaB---------- Emigrant	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
EbA*, EbC*:												
Emigrant-------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Beckton Variant	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
EcD*:												
Emigrant-------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Conata---------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Low.
ErB*, ErC*, ErD*:												
Emigrant------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Razor---------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	High.
Fv*. Fluvaquents												
Ha---------- Haverson	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Hc*:												
Haverson-------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Craft----------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Ho---------- Hilmoe	C	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
HpC---------- Hisle	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
HrC*:												
Hisle----------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.
Rock outcrop.												

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
HsC*:												
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Slickspots.												
Hu Hurley	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
In, Io Interior	B	Frequent	Brief	Mar-Oct	>6.0	---	---	>60	---	Low	High	Moderate.
IsB*:												
Interior	B	Frequent	Brief	Mar-Oct	>6.0	---	---	>60	---	Low	High	Moderate.
Cedarpass	B	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Badland.												
Iv*:												
Interior	B	Frequent	Brief	Mar-Oct	>6.0	---	---	>60	---	Low	High	Moderate.
Denby	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Cedarpass	B	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Ko Kolls	D	None	---	---	+.5-1.5	Perched	Apr-Jun	>60	---	Moderate	High	Moderate.
KyA, KyB, KyC Kyle	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
LcD*:												
Larvie	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Conata	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
LhC*:												
Larvie	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Lo Lohmiller	C	Rare	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
MhA*, MhB*:												
Metre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
MoB*:												
Metre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Larvie	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
MyE--- Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
NkD*:												
Nihill	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
NoA--- Norka	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
NpD*:												
Norka	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Colby	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
NrC*:												
Norrest	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Wanblee	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
NuA, NuB, NuC, NuD--- Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
NwB*:												
Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Beckton	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
NxD*:												
Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Nihill	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
OrE*:												
Orella	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Rock outcrop.												
PcB, PcC--- Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
PhB*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
PkD*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
PrA---- Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
PsA*, PsB*:												
Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Hurley	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
PuB*, PuC*:												
Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
RhC*:												
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
RmD*:												
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
SaF---- Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
ShE*:												
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Rock outcrop.												
SpE*:												
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
SrF*:												
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Rock outcrop.												
SwB*:												
Savo	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Dawes	C	None	---	---	>6.0	---	---	>60	---	Low	High	High.
VwC*:												
Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Wortman	A	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Wb Wendte	D	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
Wc Wendte	D	Occasional	Brief	Apr-Oct	>6.0	---	---	>60	---	Low	High	Low.
WeA Weta	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
WhA Whitewater	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WsC*:												
Wortman	A	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available. LL means liquid limit; PI, plasticity index; MD, maximum dry density; and OM, optimum moisture]

Soil name, sample number, horizon, and depth in inches	Classification		Grain-size distribution								LL	PI	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			MD	OM
											Pct		Lb/ft^3	Pct
Blackpipe silt loam: (S81SD-071-36)														
A------- 0 to 5	A-6(10)	CL	100	100	100	99	92	---	35	---	39	16	97	23
Bt, Btk- 5 to 15	A-7-6(19)	CH	100	100	100	100	95	---	47	---	53	30	92	26
Bk1, Bk2---- 15 to 28	A-7-6(15)	CL	100	100	100	100	92	---	43	---	43	24	101	21
Cactusflat silty clay: (S80SD-071-18)														
Bw1----- 2 to 10	A-7-6(19)	CH	100	100	100	100	96	---	56	---	58	33	90	27
Bw2, Bk- 10 to 22	A-7-6(19)	CH	100	100	100	100	95	---	52	---	56	35	93	25
2C1, 2C2---- 22 to 60	A-7-6(15)	CL	100	100	100	100	96	---	40	---	44	26	102	20
Cedarpass silt loam: (S81SD-071-12)														
Bw1----- 5 to 11	A-6(9)	CL	100	100	100	100	98	---	34	---	33	12	97	23
C1, C2-- 19 to 42	A-7-6(18)	CL	100	100	100	100	94	---	42	---	49	29	100	22
Conata clay: (S81SD-071-21)														
A1, A2-- 0 to 6	A-7-6(20)	CH	100	99	99	99	97	---	65	---	65	37	90	27
Bw, Bk-- 6 to 18	A-7-6(20)	CH	100	99	99	99	96	---	67	---	65	40	96	24
Denby silty clay: (S81SD-071-11)														
A, Bw1, Bw2---- 0 to 21	A-7-6(20)	CH	100	100	100	100	99	---	74	---	77	48	85	31
BC, C, Ab----- 21 to 36	A-7-6(19)	CH	100	100	100	100	98	---	50	---	54	32	97	23
C1------ 36 to 60	A-7-6(14)	CL	100	100	100	100	93	---	32	---	42	24	104	20
Interior loam: (S81SD-071-13)														
A, C1, C2, C3- 0 to 34	A-6(10)	CL	100	100	100	99	88	---	24	---	36	16	104	20
C4------ 34 to 49	A-6(10)	CL	100	100	100	100	90	---	26	---	37	16	106	19
Midway silty clay loam: (S81SD-071-33)														
C------- 6 to 14	A-7-6(17)	CL	100	100	100	99	87	---	48	---	46	29	104	20

TABLE 17.--ENGINEERING INDEX TEST DATA--Continued

Soil name, sample number, horizon, and depth in inches	Classification		Grain-size distribution								LL	PI	Moisture density	
			Percentage passing sieve--					Percentage smaller than--						
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			MD	OM
											Pct		Lb/ft^3	Pct
Nunn loam: (S81SD-071-4)														
BA, Bt-- 5 to 26	A-7-6(15)	CL	100	99	99	95	85	---	44	---	46	26	100	22
Btk, Bk, C------ 26 to 60	A-6(3)	CL	100	100	100	80	41	---	26	---	33	19	119	13
Weta silt loam: (S80SD-071-16)														
Bt1, Bt2---- 2 to 10	A-7-6(19)	CH	100	100	100	100	96	---	52	---	57	34	89	28
Bkz1---- 10 to 25	A-7-6(19)	CH	100	100	100	100	96	---	54	---	57	35	93	25
Whitewater clay: (S81SD-071-29)														
A, Bw--- 0 to 14	A-7-6(20)	CH	100	100	100	99	97	---	56	---	65	40	89	28
Bw2, Bkz---- 14 to 28	A-7-6(20)	CH	100	100	100	100	98	---	58	---	71	48	92	26

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Absted	Fine, montmorillonitic, mesic Haplustollic Natrargids
Arvada	Fine, montmorillonitic, mesic Ustollic Natrargids
Bankard Variant	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Ustic Torrifluvents
Beckton	Fine, montmorillonitic, mesic Aridic Natrustolls
Beckton Variant	Fine, montmorillonitic, mesic Aridic Natrustolls
Blackpipe	Fine, montmorillonitic, mesic Aridic Argiustolls
Cactusflat	Fine, montmorillonitic, mesic Torrertic Haplustolls
Cedarpass	Fine-silty, mixed, mesic Ustollic Camborthids
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Conata	Clayey, montmorillonitic, mesic, shallow Ustollic Camborthids
Craft	Coarse-silty, mixed (calcareous), mesic Ustic Torrifluvents
*Dawes	Fine, mixed, mesic Aridic Paleustolls
Denby	Fine, montmorillonitic, mesic Ustertic Camborthids
Emigrant	Fine, montmorillonitic, mesic Aridic Argiustolls
Fluvaquents	Calcareous, mesic Aeric Fluvaquents
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Hilmoe	Clayey over loamy, montmorillonitic, mesic Fluventic Haplustolls
Hisle	Fine, montmorillonitic, mesic Ustollic Natrargids
*Hurley	Very fine, montmorillonitic, mesic Leptic Natrustolls
Interior	Fine-silty, mixed (calcareous), mesic Ustic Torrifluvents
Kolls	Very fine, montmorillonitic (calcareous), mesic Vertic Haplaquolls
Kyle	Very fine, montmorillonitic, mesic Typic Torrerts
Larvie	Very fine, montmorillonitic, mesic Typic Torrerts
Lohmiller	Fine, montmorillonitic (calcareous), mesic Ustic Torrifluvents
Metre	Very fine, montmorillonitic, mesic Mollic Torrerts
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Norka	Fine-silty, mixed, mesic Aridic Argiustolls
Norrest	Fine, montmorillonitic, mesic Ustollic Haplargids
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Orella	Clayey, mixed (calcareous), mesic, shallow Ustic Torriorthents
Pierre	Very fine, montmorillonitic, mesic Typic Torrerts
Promise	Very fine, montmorillonitic, mesic Udic Chromusterts
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Samsil	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Savo	Fine, montmorillonitic, mesic Aridic Argiustolls
Valent	Mixed, mesic Ustic Torripsamments
Wanblee	Fine, montmorillonitic, mesic Ustollic Natrargids
Wendte	Fine, montmorillonitic (calcareous), mesic Vertic Ustifluvents
Weta	Fine, montmorillonitic, mesic Leptic Natrustolls
Whitewater	Very fine, montmorillonitic, mesic Typic Torrerts
Wortman	Fine, montmorillonitic, mesic Aridic Natrustolls

Interpretive Groups

INTERPRETIVE GROUPS

[Dashes indicate that the soil is not assigned to the interpretive group]

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
Ab Absted	IVs-2	Claypan	9
Ar Arvada	VIs-3	Thin Claypan	10
As:			
Arvada	VIs-3	Thin Claypan	10
Slickspots	VIIIs-3	---	---
Ba Badland	VIIIs-2	---	---
BcB Beckton	IVs-2	Claypan	9
BdA:			
Beckton	IVs-2	Claypan	9
Arvada	VIs-3	Thin Claypan	10
BwC:			
Blackpipe	IVe-1	Silty	6R
Wortman	VIs-5	Claypan	9
CaA Cactusflat	IIIs-1	Clayey	4C
CbB:			
Cactusflat	IIIs-1	Clayey	4C
Weta	VIs-3	Thin Claypan	10
CeA Cedarpass	IVe-8	Silty	8
CfA:			
Cedarpass	IVe-8	Silty	8
Denby	IVs-6	Clayey	4C
CoD Colby	VIe-3	Thin Upland	8
Cv:			
Craft	IIIc-2	Loamy Terrace	1
Bankard Variant	VIe-8	Sands	7
EaB Emigrant	IIIe-1	Silty	6R
EbA:			
Emigrant	IIIs-5	Silty	6R
Beckton Variant	IVs-2	Claypan	9
EbC:			
Emigrant	IVe-1	Silty	6R
Beckton Variant	IVs-3	Claypan	9
EcD:			
Emigrant	VIe-1	Silty	6R
Conata	VIe-12	Shallow Clay	10

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
ErB:			
Emigrant	IIIe-1	Silty	6R
Razor	IVe-3	Clayey	4C
ErC:			
Emigrant	IVe-1	Silty	6R
Razor	IVe-14	Clayey	4C
ErD:			
Emigrant	VIe-1	Silty	6R
Razor	VIe-4	Clayey	4C
Fv Fluvaquents	VIw-2	Subirrigated	10
Ha Haverson	IIIc-2	Loamy Terrace	1
Hc Haverson-Craft	IIIc-2	Loamy Terrace	1
Ho Hilmoe	IIIs-3	Clayey Overflow	4C
HpC Hisle	VIs-3	Thin Claypan	10
HrC:			
Hisle	VIs-3	Thin Claypan	10
Rock outcrop	VIIIs-2	---	---
HsC:			
Hisle	VIs-3	Thin Claypan	10
Slickspots	VIIIs-3	---	---
Hu Hurley	VIs-3	Thin Claypan	10
In Interior	VIs-7	Badland Overflow	10
Io Interior	VIw-1	Badland Overflow	10
IsB	VIIs-6		
Interior		Badland Overflow	10
Cedarpass Badland.		Silty	8
Iv	VIs-7		
Interior		Badland Overflow	10
Denby		Clayey	4C
Cedarpass		Silty	8
Ko Kolls	Vw-1	Closed Depression	10
KyA Kyle	IIIs-3	Clayey	4C
KyB Kyle	IVe-3	Clayey	4C

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
KyC---------- Kyle	IVe-14	Clayey----------	4C
LcD:			
Larvie----------	VIe-4	Clayey----------	4C
Conata----------	VIe-12	Shallow Clay-----	10
LhC:			
Larvie----------	IVe-14	Clayey----------	4C
Hisle----------	VIs-3	Thin Claypan-----	10
Lo---------- Lohmiller	IIIc-2	Loamy Terrace----	1
MhA:			
Metre----------	IIIs-1	Clayey----------	4C
Hisle----------	VIs-3	Thin Claypan-----	10
MhB:			
Metre----------	IVe-3	Clayey----------	4C
Hisle----------	VIs-3	Thin Claypan-----	10
MoB---------- Metre-Larvie	IVe-3	Clayey----------	4C
MyE---------- Midway	VIIe-8	Shallow----------	10
NkD:			
Nihill----------	VIs-4	Shallow to Gravel	10
Samsil----------	VIe-12	Shallow Clay-----	10
NoA---------- Norka	IIIc-1	Silty----------	3
NpD----------	VIe-1		
Norka----------		Silty----------	3
Colby----------		Thin Upland------	8
NrC:			
Norrest----------	IVe-13	Clayey----------	6R
Wanblee----------	VIs-3	Thin Claypan-----	10
NuA---------- Nunn	IIIc-1	Silty----------	3
NuB---------- Nunn	IIIe-1	Silty----------	3
NuC---------- Nunn	IVe-1	Silty----------	3
NuD---------- Nunn	VIe-1	Silty----------	3
NwB:			
Nunn----------	IIIe-1	Silty----------	3
Beckton----------	IVs-2	Claypan----------	9
NxD:			
Nunn----------	VIe-1	Silty----------	3
Nihill----------	VIs-4	Shallow to Gravel	10

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
OrE:			
Orella	VIIe-5	Shallow Clay	10
Rock outcrop	VIIIs-2	---	---
PcB Pierre	IIIe-4	Clayey	4C
PcC Pierre	IVe-4	Clayey	4C
PhB:			
Pierre	IIIe-4	Clayey	4C
Hisle	VIs-3	Thin Claypan	10
PkD:			
Pierre	VIe-4	Clayey	4C
Samsil	VIe-12	Shallow Clay	10
PrA Promise	IIIs-3	Clayey	4C
PsA:			
Promise	IIIs-3	Clayey	4C
Hurley	VIs-3	Thin Claypan	10
PsB:			
Promise	IIIe-4	Clayey	4C
Hurley	VIs-3	Thin Claypan	10
PuB Promise-Pierre	IIIe-4	Clayey	4C
PuC Promise-Pierre	IVe-4	Clayey	4C
RhC:			
Razor	IVe-14	Clayey	4C
Hisle	VIs-3	Thin Claypan	10
RmD:			
Razor	VIe-4	Clayey	4C
Midway	VIe-12	Shallow	10
SaF Samsil	VIIe-8	Shallow Clay	10
ShE:			
Samsil	VIe-12	Shallow Clay	10
Hisle	VIs-3	Thin Claypan	10
Rock outcrop	VIIIs-2	---	---
SpE	VIe-12		
Samsil		Shallow Clay	10
Pierre		Clayey	10
SrF:			
Samsil	VIIe-8	Shallow Clay	10
Rock outcrop	VIIIs-2	---	---
SwB:			
Savo	IIIe-1	Silty	3
Dawes	IVe-9	Silty	9

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
VwC:			
Valent	VIe-10	Sands	7
Wortman	VIs-5	Sandy	9
Wb Wendte	IIIs-3	Clayey Overflow	4C
Wc Wendte	VIw-1	Clayey Overflow	4C
WeA Weta	VIs-3	Thin Claypan	10
WhA Whitewater	VIs-6	Dense Clay	10
WsC:			
Wortman	VIs-5	Sandy	9
Hisle	VIs-3	Thin Claypan	10

* Soils in windbreak suitability group 10 are unsuited to windbreaks.

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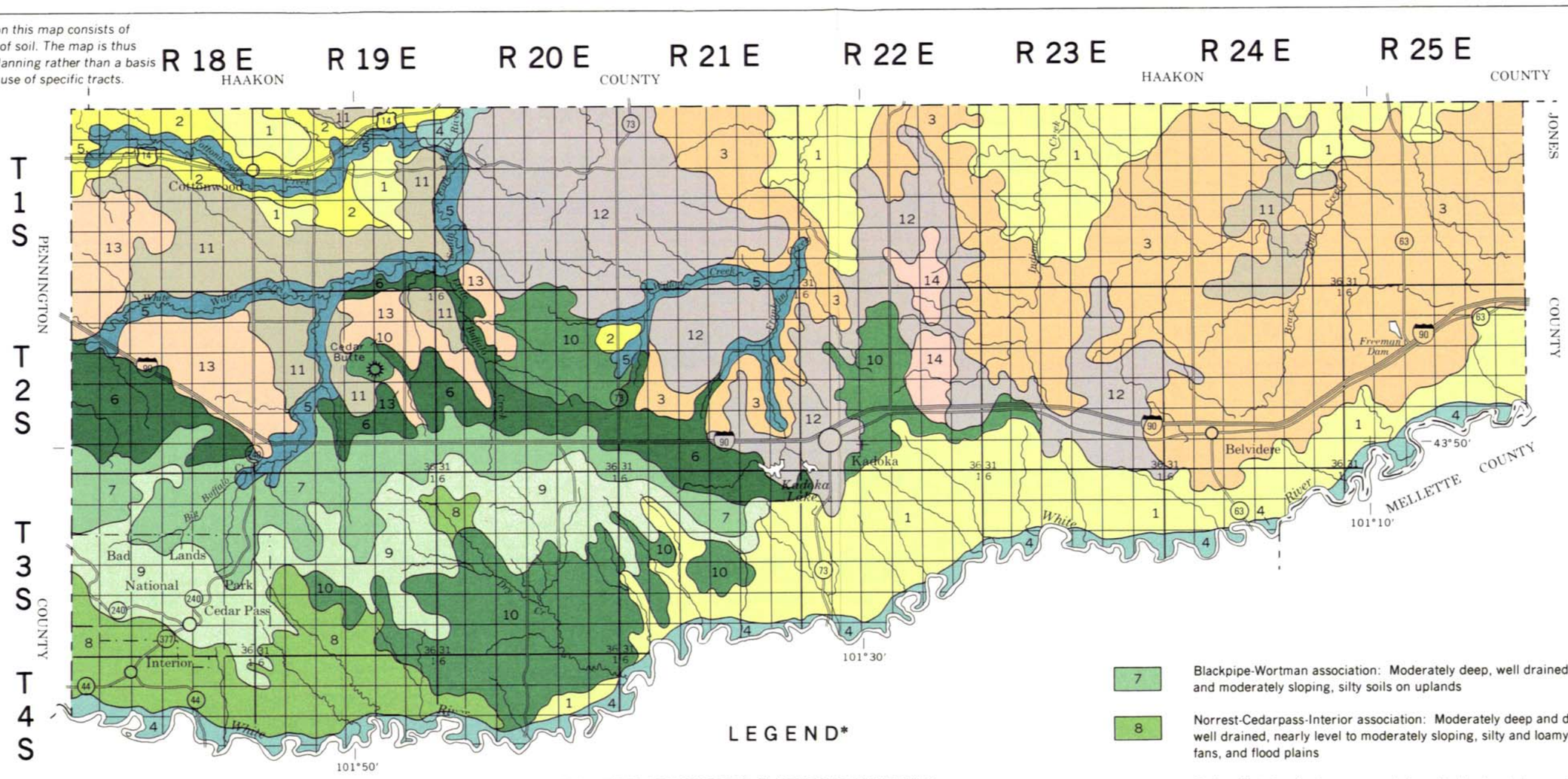
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



LEGEND*

NEARLY LEVEL TO VERY STEEP, CLAYEY SOILS ON UPLANDS

1 — Samsil-Pierre association: Shallow and moderately deep, well drained, moderately sloping to very steep, clayey soils on uplands

2 — Pierre-Kyle association: Moderately deep and deep, well drained, nearly level to moderately sloping, clayey soils on uplands

3 — Pierre-Promise association: Moderately deep and deep, well drained, nearly level to strongly sloping, clayey soils on uplands

NEARLY LEVEL, LOAMY AND SILTY SOILS ON TERRACES AND FLOOD PLAINS

4 — Haverson association: Deep, well drained, nearly level, loamy soils on flood plains

5 — Interior-Absted association: Deep, well drained, nearly level, loamy and silty soils on terraces and flood plains

BADLAND AND NEARLY LEVEL TO STRONGLY SLOPING, SILTY, LOAMY, AND CLAYEY SOILS ON UPLANDS, FANS, AND FLOOD PLAINS

6 — Weta-Cactusflat association: Deep, well drained, nearly level and gently sloping, silty and clayey soils on uplands and fans

7 — Blackpipe-Wortman association: Moderately deep, well drained, gently sloping and moderately sloping, silty soils on uplands

8 — Norrest-Cedarpass-Interior association: Moderately deep and deep, well drained, nearly level to moderately sloping, silty and loamy soils on uplands, fans, and flood plains

9 — Badland-Interior-Cedarpass association: Badland and deep, well drained, nearly level and gently sloping, loamy and silty soils on uplands, fans, and flood plains

10 — Hisle-Larvie association: Moderately deep, well drained, nearly level to strongly sloping, silty and clayey soils on uplands

NEARLY LEVEL TO STEEP, CLAYEY, SILTY, AND LOAMY SOILS ON UPLANDS AND TERRACES

11 — Nunn-Pierre association: Deep and moderately deep, well drained, nearly level to strongly sloping, loamy and clayey soils on terraces and uplands

12 — Emigrant-Razor-Midway association: Moderately deep and shallow, well drained, nearly level to steep, loamy and silty soils on uplands

13 — Nunn-Beckton-Hisle association: Deep and moderately deep, well drained, nearly level to moderately sloping, loamy and silty soils on uplands and terraces

14 — Beckton-Arvada association: Deep, well drained, nearly level and gently sloping, sodium affected, loamy soils on terraces and uplands

*The texture terms in the descriptive headings refer to the surface layer of the major soils in each association.

Compiled 1985

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE AND FOREST SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

JACKSON COUNTY
NORTHERN PART
SOUTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

R 18 E R 19 E R 20 E R 21 E R 22 E R 23 E R 24 E R 25 E

HAAKON COUNTY HAAKON COUNTY

T 1 S T 2 S T 3 S T 4 S

PENNINGTON COUNTY

JONES COUNTY

MELLETTE COUNTY

N

Cottonwood

Cedar Butte

Kadoka

Belvidere

Cedar Pass

Interior

Bad Lands National Park

Kadoka Lake

Freeman Dam

Cottonwood Creek

Back Rock River

South Fork Little Buffalo Creek

White Water Creek

Willow Creek

Franklin Creek

Indian Creek

Butte Creek

Brave Creek

Big Buffalo Creek

White River

1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 26 27

28 29 30 31 32 33 34 35

36 37 38 39 40 41 42

43 44 45 46

36 31 / 1 6

43°50'

101°10'

101°30'

101°50'

Inset, sheet 42

Inset, sheet 46

Inset, sheet 43

Inset, sheet 41

Inset, sheet 46

INDEX TO MAP SHEETS

JACKSON COUNTY
NORTHERN PART
SOUTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate slope phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
Ab	Absted silt loam
Ar	Arvada loam
As	Arvada-Slickspots complex
Ba	Badland
BcB	Beckton loam, 2 to 6 percent slopes
BdA	Beckton-Arvada loams, 0 to 2 percent slopes
BwC	Blackpipe-Wortman silt loams, 3 to 9 percent slopes
CaA	Cactusflat silty clay, 0 to 3 percent slopes
CbB	Cactusflat-Weta complex, 1 to 6 percent slopes
CeA	Cedarpass silt loam, 0 to 3 percent slopes
CfA	Cedarpass-Denby complex, 0 to 4 percent slopes
CoD	Colby silt loam, 6 to 15 percent slopes
Cv	Craft-Bankard Variant very fine sandy loams
EaB	Emigrant loam, 1 to 6 percent slopes
EbA	Emigrant-Beckton Variant loams, 0 to 2 percent slopes
EbC	Emigrant-Beckton Variant loams, 2 to 9 percent slopes
EcD	Emigrant-Conata complex, 6 to 15 percent slopes
ErB	Emigrant-Razor complex, 1 to 6 percent slopes
ErC	Emigrant-Razor complex, 6 to 9 percent slopes
ErD	Emigrant-Razor complex, 9 to 15 percent slopes
Fv	Fluvaquents, flooded
Ha	Haverson loam
Hc	Haverson-Craft complex
Ho	Hilmoe silty clay
HpC	Hisle silt loam, 0 to 9 percent slopes
HrC	Hisle-Rock outcrop complex, 0 to 9 percent slopes
HsC	Hisle-Slickspots complex, 0 to 9 percent slopes
Hu	Hurley silt loam
In	Interior loam
Io	Interior loam, channeled
IsB	Interior-Cedarpass-Badland complex, 0 to 6 percent slopes
Iv	Interior-Denby-Cedarpass complex, 0 to 3 percent slopes
Ko	Kolls clay
KyA	Kyle clay, 0 to 3 percent slopes
KyB	Kyle clay, 3 to 6 percent slopes
KyC	Kyle clay, 6 to 9 percent slopes
LcD	Larvie-Conata clays, 6 to 15 percent slopes
LhC	Larvie-Hisle complex, 2 to 9 percent slopes
Lo	Lohmiller silty clay
MhA	Metre-Hisle complex, 0 to 2 percent slopes
MhB	Metre-Hisle complex, 2 to 6 percent slopes
MoB	Metre-Larvie clays, 2 to 6 percent slopes
MyE	Midway silty clay loam, 15 to 40 percent slopes
NkD	Nihill-Samsil complex, 6 to 15 percent slopes
NoA	Norka silt loam, 0 to 3 percent slopes
NpD	Norka-Colby silt loams, 6 to 15 percent slopes
NrC	Norrest-Wanblee complex, 2 to 9 percent slopes
NuA	Nunn loam, 0 to 3 percent slopes
NuB	Nunn loam, 3 to 6 percent slopes
NuC	Nunn loam, 6 to 9 percent slopes
NuD	Nunn loam, 8 to 15 percent slopes
NwB	Nunn-Beckton loams, 2 to 6 percent slopes
NxD	Nunn-Nihill complex, 6 to 15 percent slopes
OrE	Orella-Rock outcrop complex, 3 to 45 percent slopes
PcB	Pierre clay, 3 to 6 percent slopes
PcC	Pierre clay, 6 to 9 percent slopes
PhB	Pierre-Hisle complex, 1 to 6 percent slopes
PkD	Pierre-Samsil clays, 6 to 15 percent slopes
PrA	Promise clay, 0 to 3 percent slopes
PsA	Promise-Hurley complex, 0 to 3 percent slopes
PsB	Promise-Hurley complex, 3 to 6 percent slopes
PuB	Promise-Pierre clays, 3 to 6 percent slopes
PuC	Promise-Pierre clays, 6 to 9 percent slopes
RhC	Razor-Hisle complex, 2 to 9 percent slopes
RmD	Razor-Midway silty clay loams, 6 to 15 percent slopes
SaF	Samsil clay, 15 to 40 percent slopes
ShE	Samsil-Hisle-Rock outcrop complex, 6 to 25 percent slopes
SpE	Samsil-Pierre clays, 15 to 25 percent slopes
SrF	Samsil-Rock outcrop complex, 25 to 60 percent slopes
SwB	Savo-Dawes silt loams, 2 to 6 percent slopes
VwC	Valent-Wortman loamy fine sands, 3 to 9 percent slopes
Wb	Wendte clay
Wc	Wendte clay, channeled
WeA	Weta silt loam, 0 to 3 percent slopes
WhA	Whitewater clay, 0 to 3 percent slopes
WsC	Wortman-Hisle complex, 2 to 9 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

County or parish

Reservation (national forest or park, state forest or park, and large airport)

Limit of soil survey (label)

Field sheet matchline & neatline

AD HOC BOUNDARY (label)

Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

Divided (median shown if scale permits)

Other roads

Trail

ROAD EMBLEMS & DESIGNATIONS

Interstate

Federal

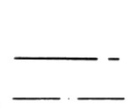
State

RAILROAD

DAMS

Large (to scale)

Medium or small



PITS

Gravel pit

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)

Church

WATER FEATURES

DRAINAGE

Perennial, double line

Intermittent

Drainage end

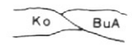
MISCELLANEOUS WATER FEATURES

Marsh or swamp

Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS



MISCELLANEOUS

Gravelly spot (<8 acres)

Gumbo, slick or scabby spot (sodic) (<8 acres)

Rock outcrop (includes sandstone and shale)

Borrow area

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 1

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 1

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PENNINGTON COUNTY

HAAKON COUNTY

1 560 000 FEET

R. 18 E.

605 000 FEET

T. 1 S.

CHICAGO AND NORTHWESTERN

Lost Lake Creek

Cottonwood Creek

Draw

Jackrabbit Draw

water

(Joins sheet 2)

(Joins sheet 10)

1 580 000 FEET

595 000 FEET

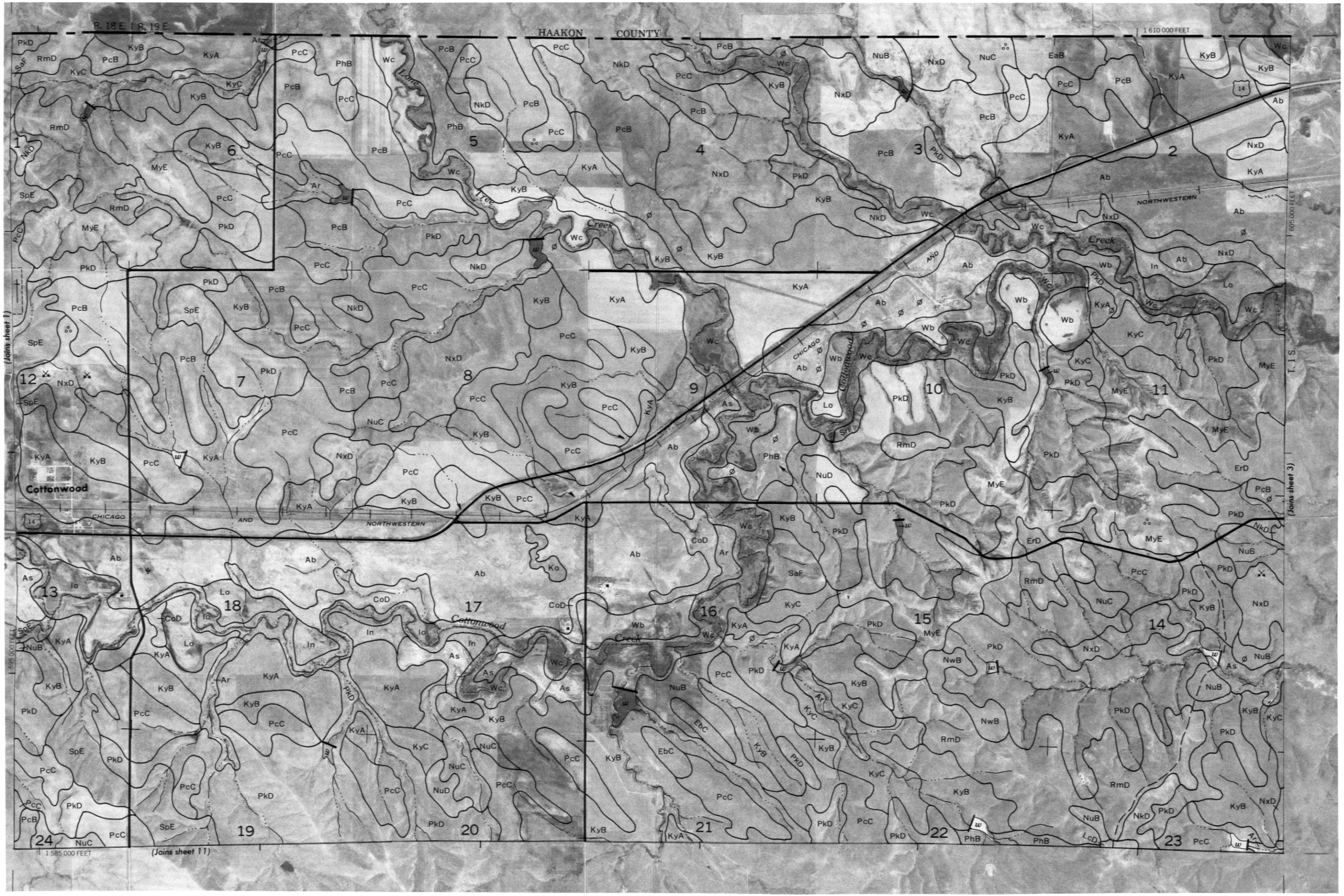
N

2 MILES

2 KILOMETERS

Scale 1:24000

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 2



Scale 1:24000

2 MILES 0 1 2

2 KILOMETERS 0 0.5 1/2 1/4 0 1/4 3/4 1

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 2

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 3

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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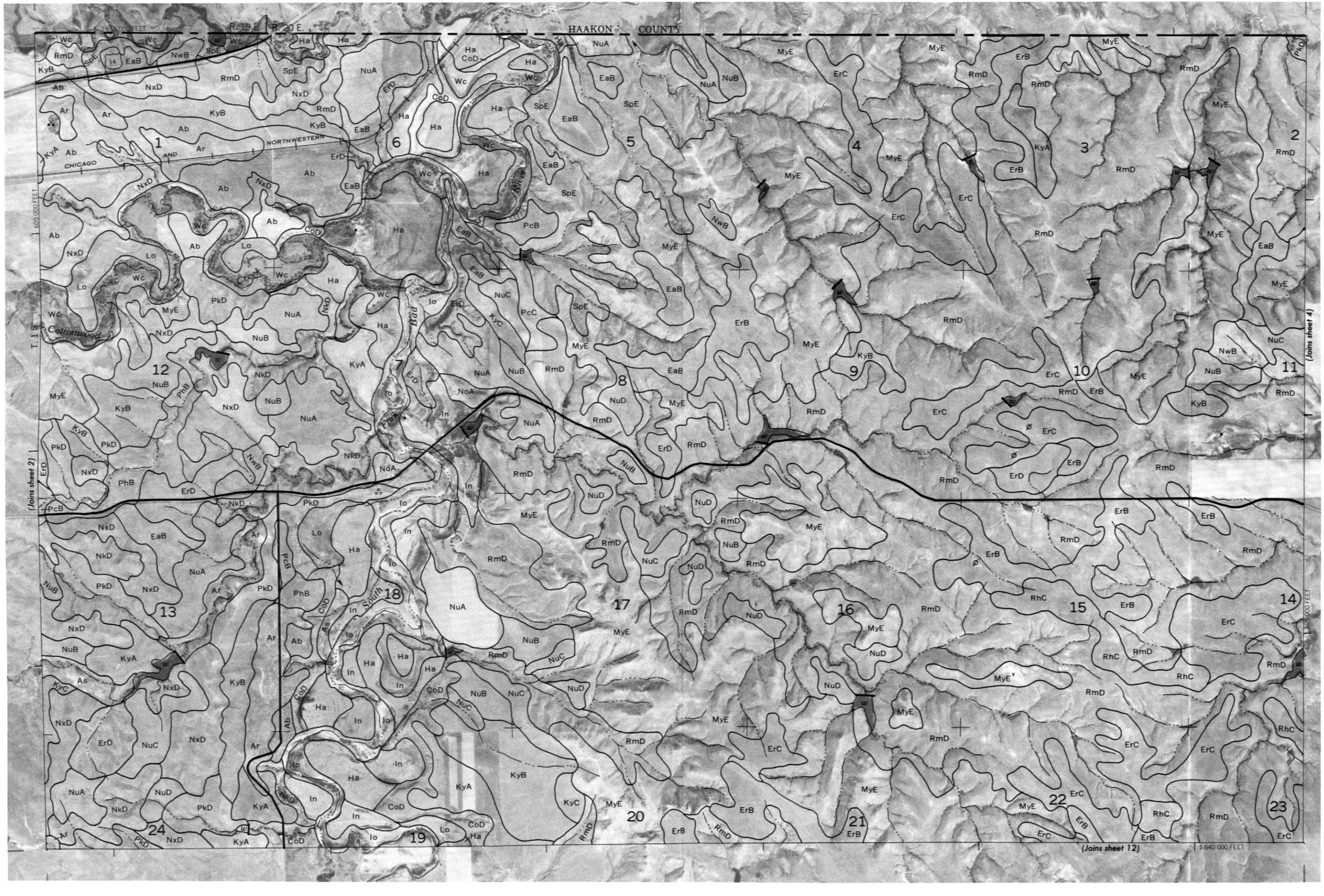
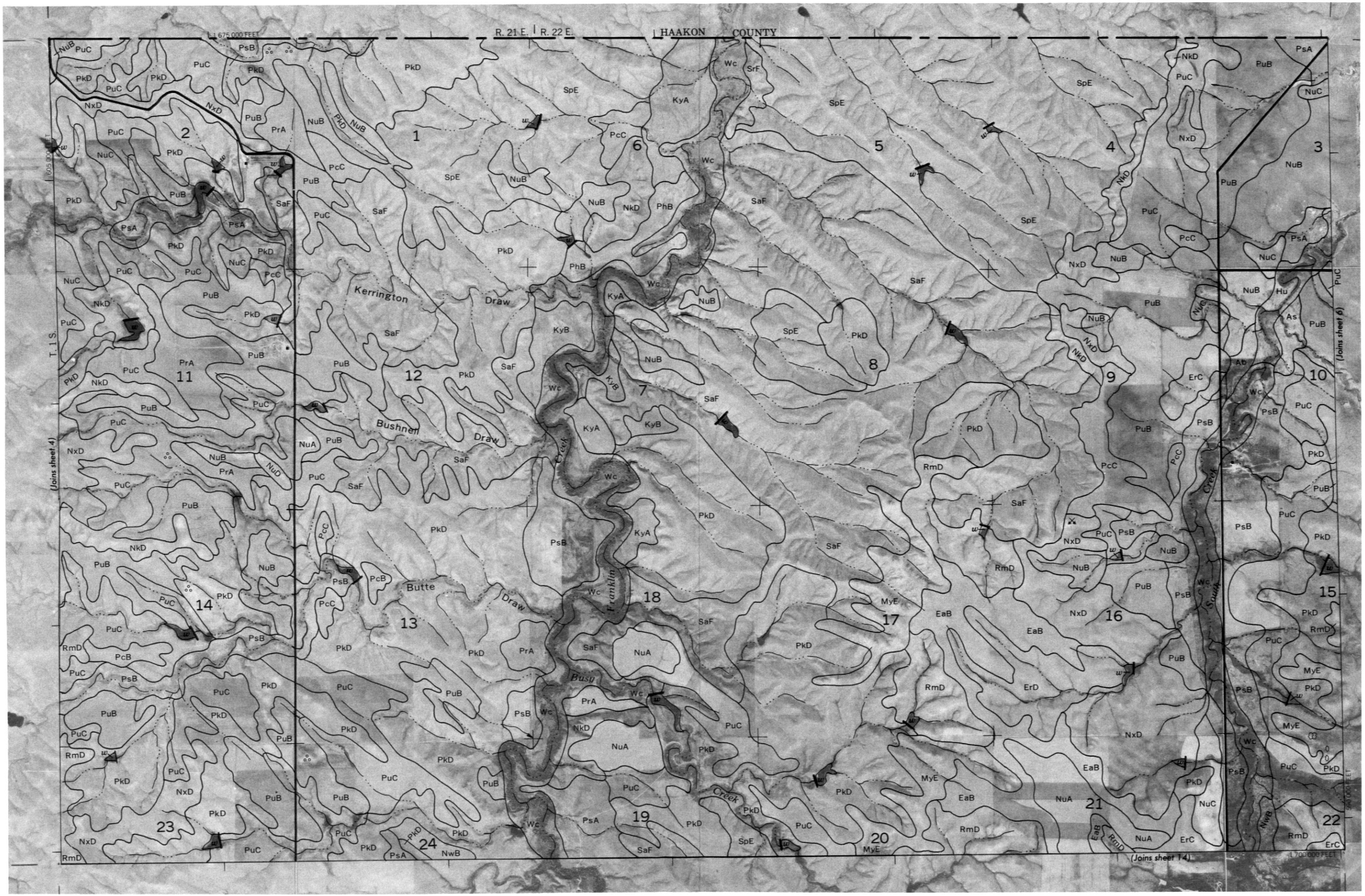


JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 4

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 4



JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 5

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

2 MILES

2 KILOMETERS

Scale 1:24000

6

N

R. 22 E. | R. 23 E. HAAKON COUNTY

725 000 FEET

605 000 FEET

T 1 S.

Johnson

Hill

Negro Draw

Big water

Wolf Hill

Big Negro Draw

Dead Horse Draw

Little Negro Creek

Indian Creek

South Hu Creek

Raiders Hills

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 15)

1 706 000 FEET

2 MILES

2 KILOMETERS

Scale 1:24000

0 0.5 1/4 1/2 3/4 1

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 6

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 7

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 23 E. | R. 24 E.

HAAKON COUNTY

1 730 000 FEET

605 000 FEET

T. 1 S.

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 16)

1 755 000 FEET

590 000 FEET

7

N

2 MILES

2 KILOMETERS

Scale 1:24000

1 0 1

3/4 1/4 0

1 1/2 0.5 1

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 8

8

N

2 MILES

2 KILOMETERS

Scale 1:24000

1 0 1/4 0.5 0 1/2 3/4 1

HAAKON COUNTY

R. 24 E. | R. 25 E.

T. 1 S.

1 785 000 FEET

605 000 FEET

560 000 FEET

1 760 000 FEET

(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 17)

Bull Creek

Bradic Creek

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 8

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 9

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 9

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 790 000 FEET
605 000 FEET
R. 25 E.
HAAKON COUNTY
JONES COUNTY
T. 1 S.
(Joins sheet 8)
(Joins sheet 18)
590 000 FEET
1 815 000 FEET
Creek
water

9

N

2 MILES
2 KILOMETERS

Scale 1:24000

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 10

10

N

2 MILES

2 KILOMETERS

Scale 1:24000

PENNINGTON COUNTY

(Joins sheet 1)

R. 18 E.

1 580 000 FEET

590 000 FEET

Jackrabbit Draw

Whitewater Creek

water

(Joins sheet 11)

(Joins sheet 19)

1 575 000 FEET

T. 2 S.

T. 1 S.

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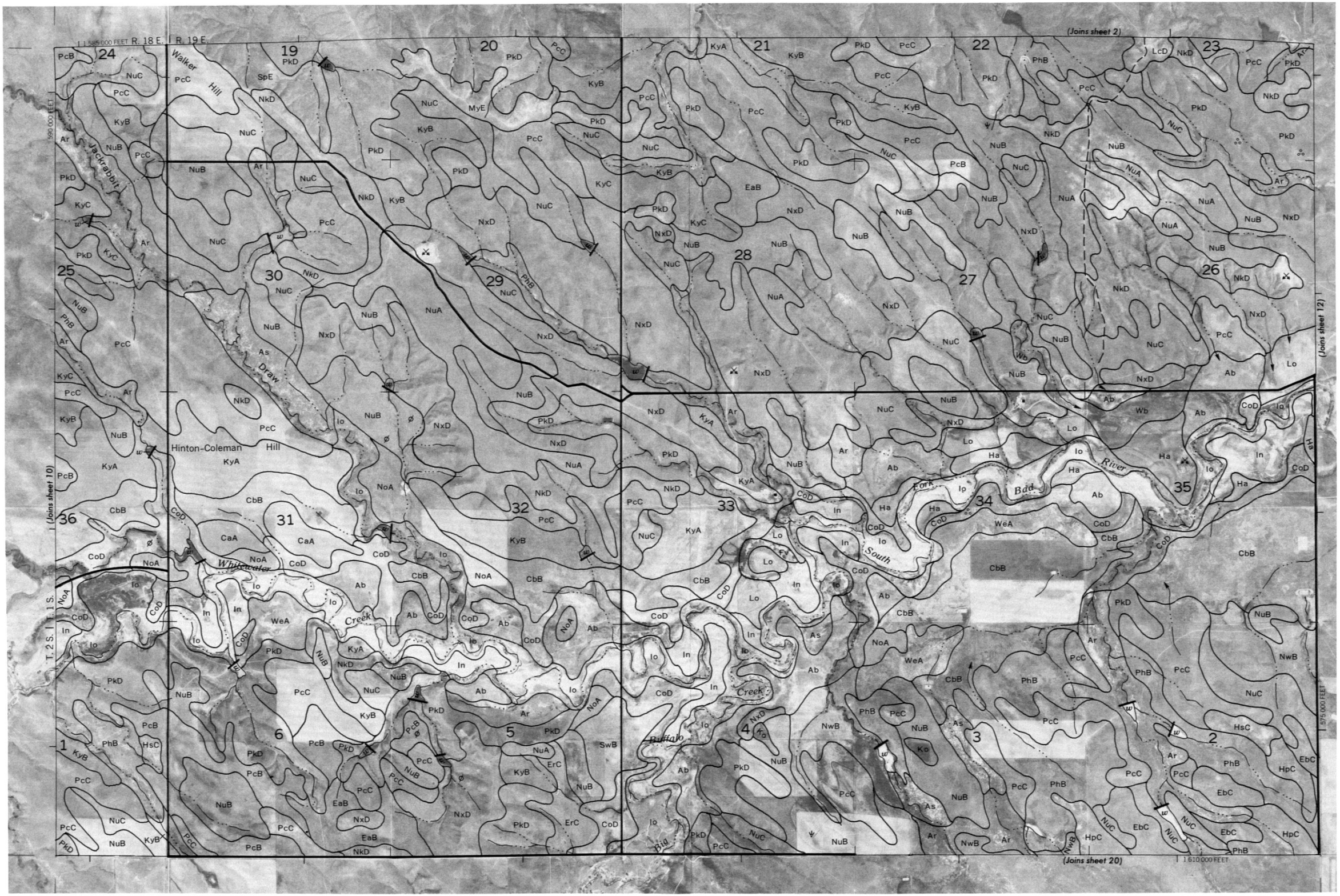
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 10

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 11



JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 11

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11

N

2 MILES

2 KILOMETERS

Scale 1:24000

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 12

12

N

Scale 1:24000

2 MILES 0 1/4 0.5 1/2 3/4 1

2 KILOMETERS 0 1

(Joins sheet 3) R. 19 E. R. 20 E. 640 000 FEET 590 000 FEET

(Joins sheet 11) 575 000 FEET 1 515 000 FEET (Joins sheet 21)

(Joins sheet 13) T. 2 S. R. 1 E.

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JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 12

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 13

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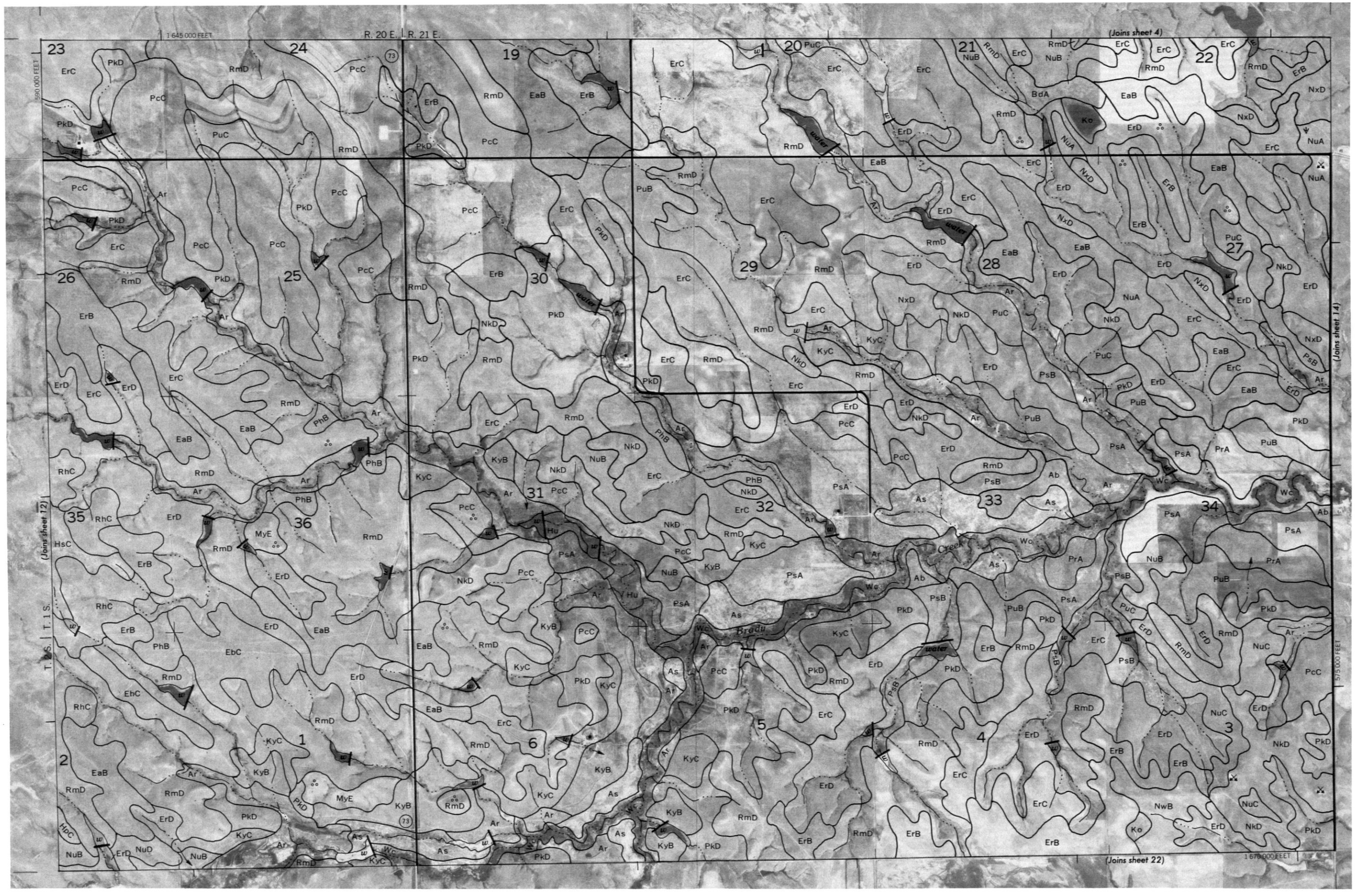

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 14

14

N

Scale 1:24000

2 MILES 0 1/2 1

2 KILOMETERS 0 0.5 1

R. 21 E. R. 22 E.

T. 1 S.

T. 2 S.

(Joins sheet 5)

(Joins sheet 13)

(Joins sheet 23)

(Joins sheet 15)

1 700 000 FEET

1 675 000 FEET

Bush Creek

Willow Creek

Brady Creek

White Clay Creek

Custer Creek

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JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 14

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 15

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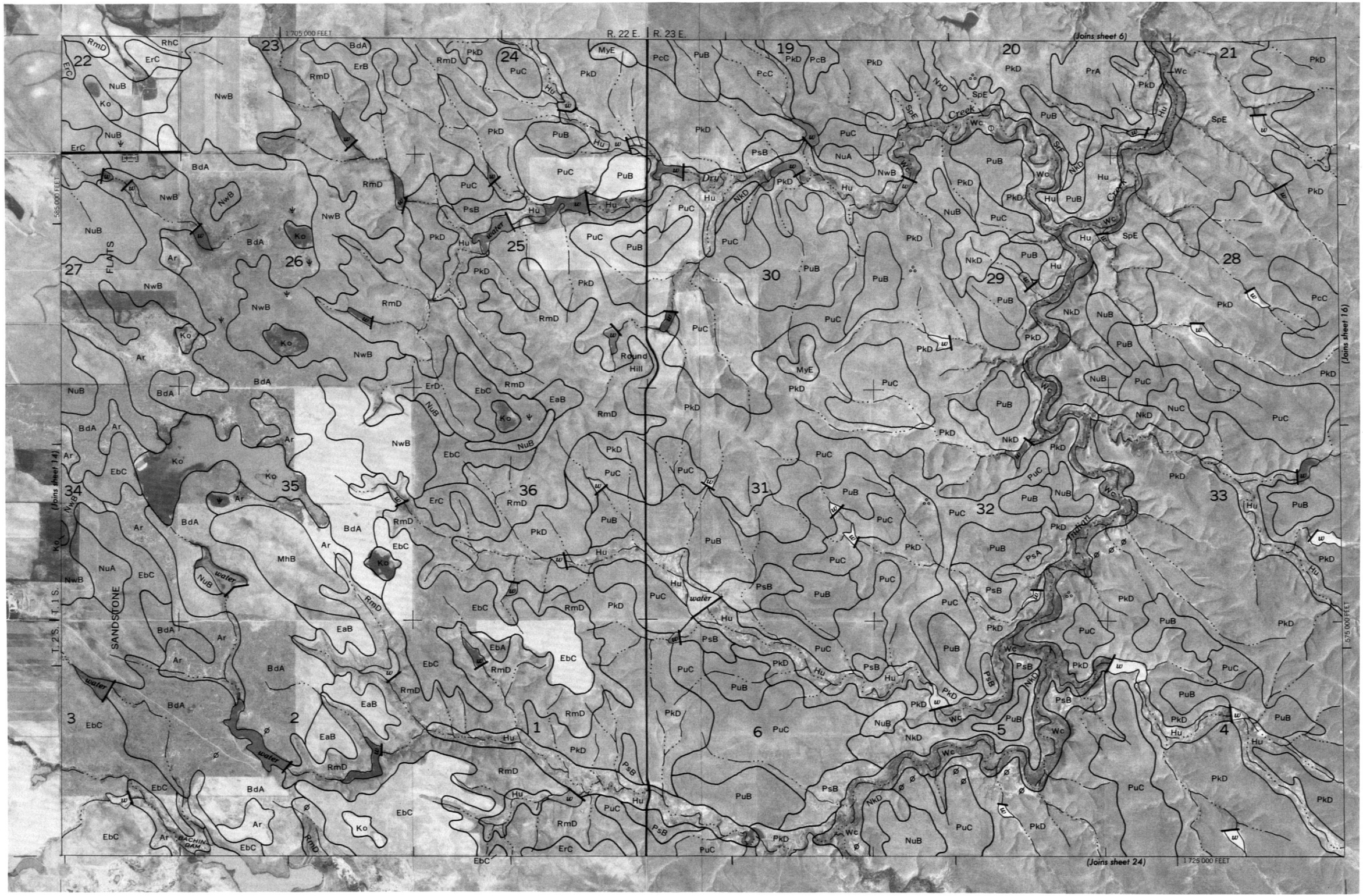

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 16

16

N

2 MILES

2 KILOMETERS

Scale 1:24000

R. 23 E. | R. 24 E.

T. 1 S.

T. 2 S.

1 755 000 FEET

585 000 FEET

575 000 FEET

1 730 000 FEET

(Joins sheet 7)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 25)

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
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JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 16

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 17

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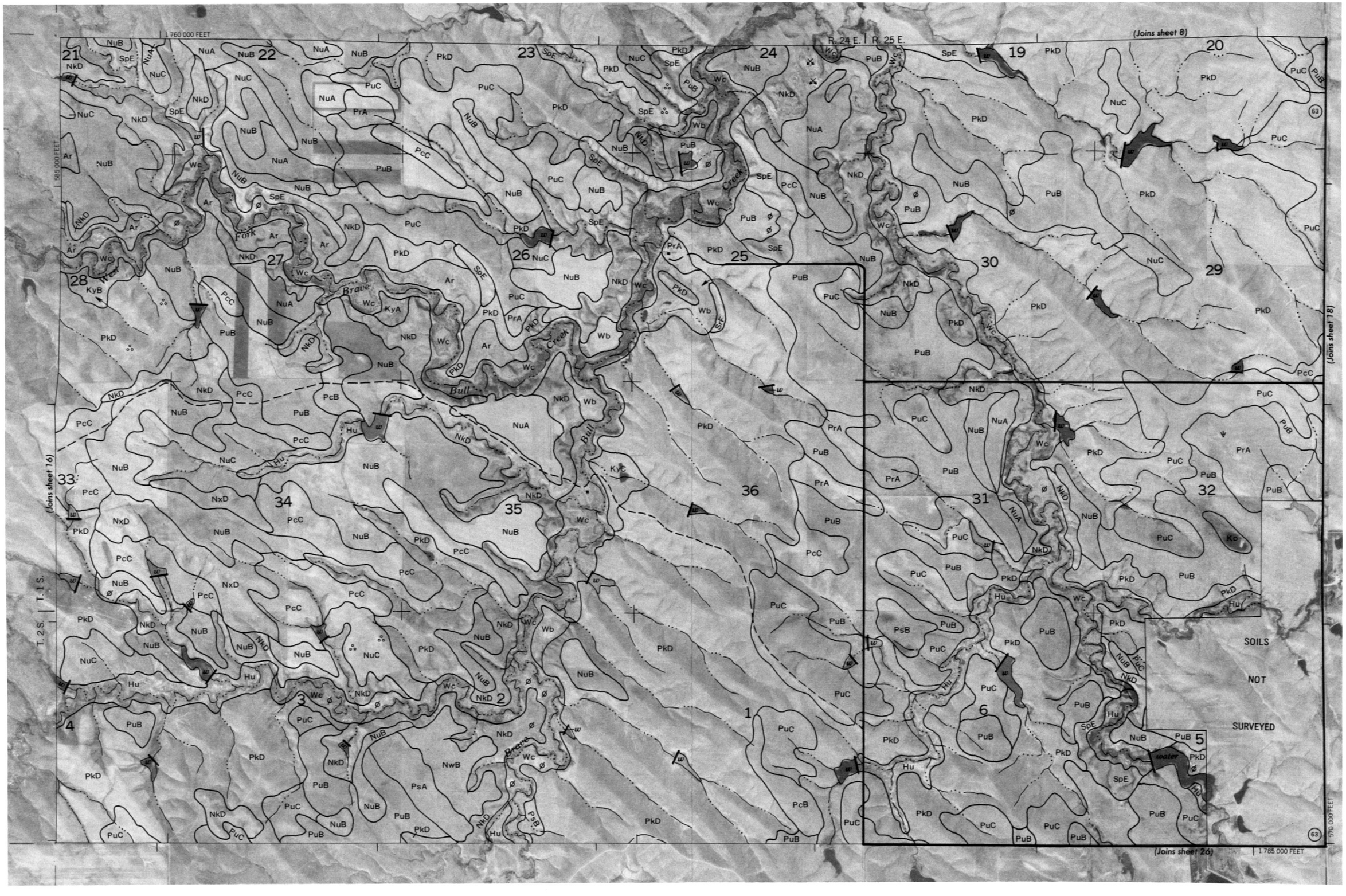

N

2 MILES 0 1/2 1 3/4 1

2 KILOMETERS 0 0.5 1

Scale 1:24000

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 18

18

N

2 MILES

2 KILOMETERS

Scale 1:24000

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 18

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 19

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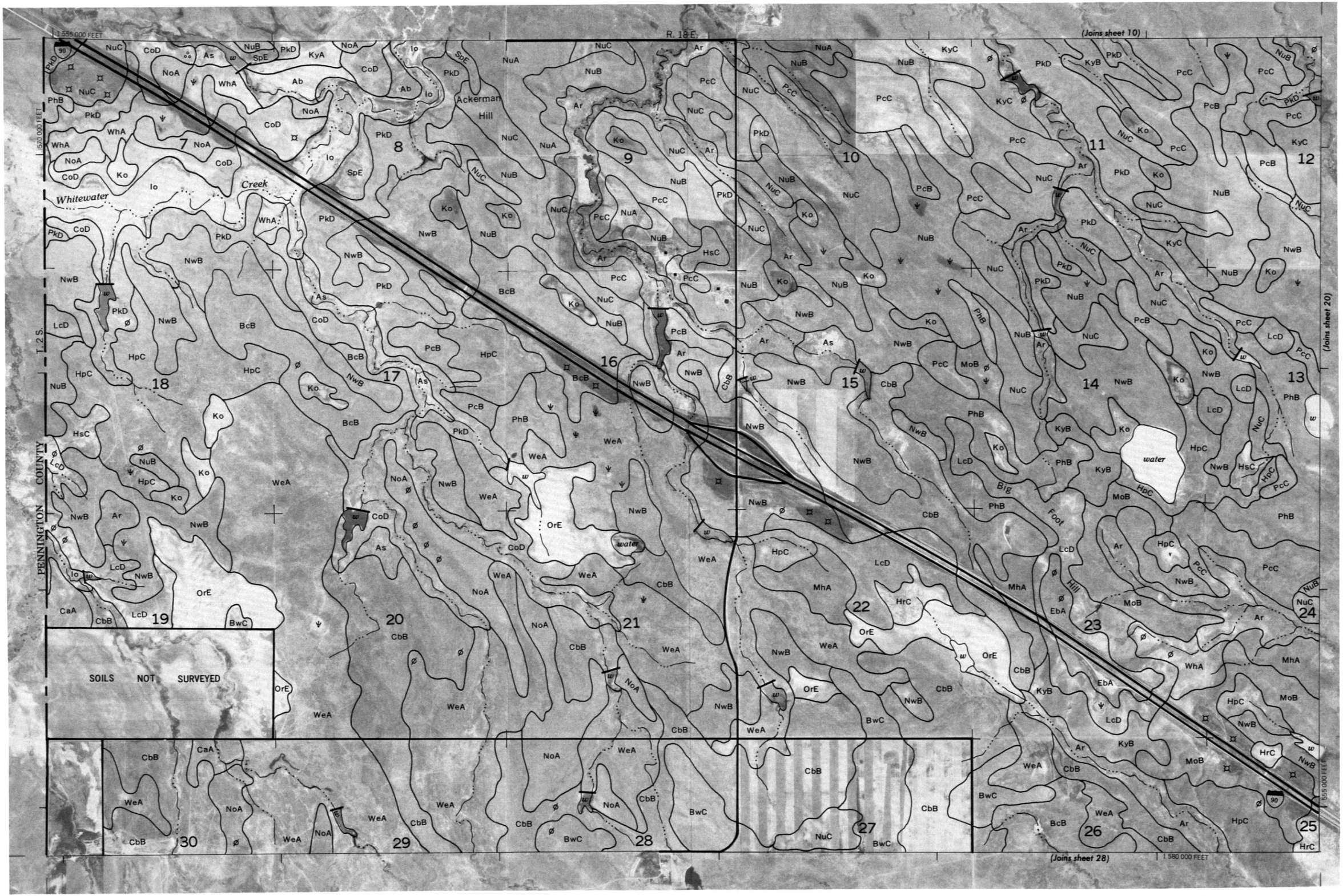

N

2 MILES

2 KILOMETERS

Scale 1:24000

N

R. 18 E. R. 19 E. (Joins sheet 11)

1 610 000 FEET

570 000 FEET

T. 2 S.

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 29)

1 555 000 FEET

Scale 1:24000

2 MILES 2 KILOMETERS

0 0.5 1/4 1/2 3/4 1

Cedar Butte

Washburn Ridge

Cactus Flat

ARKE DAM

Io Creek

Buffalo Big Creek

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JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 21

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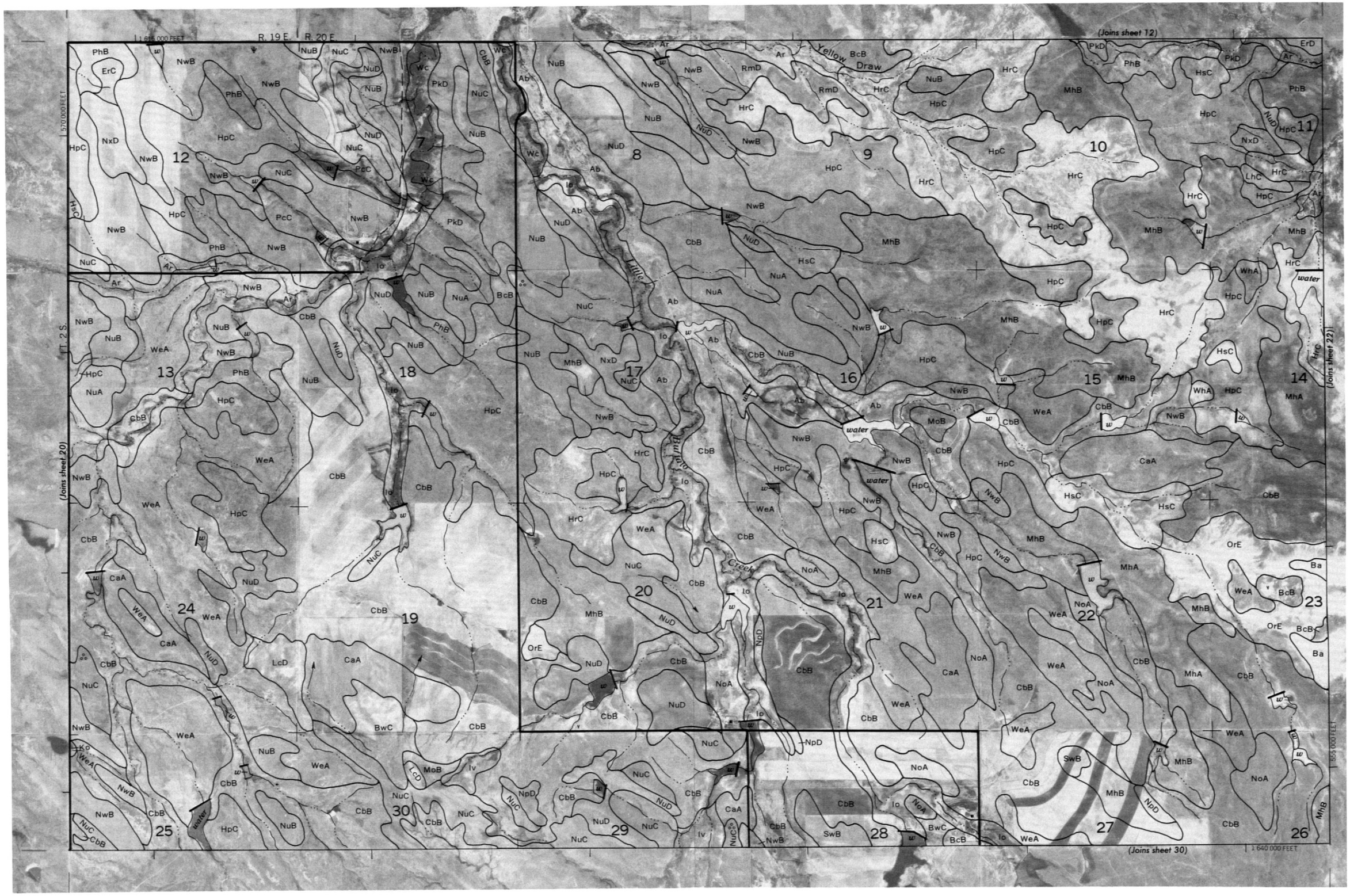


21

N

2 MILES

2 KILOMETERS

Scale 1:24000

0 0 1/4 0.5 1/2 3/4

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 22

22

N

2 MILES

2 KILOMETERS

Scale 1:24000

R. 20 E. R. 21 E.

(Joins sheet 13)

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 31)

1 670 000 FEET

570 000 FEET

555 000 FEET

1 645 000 FEET

T. 2 S.

Creek

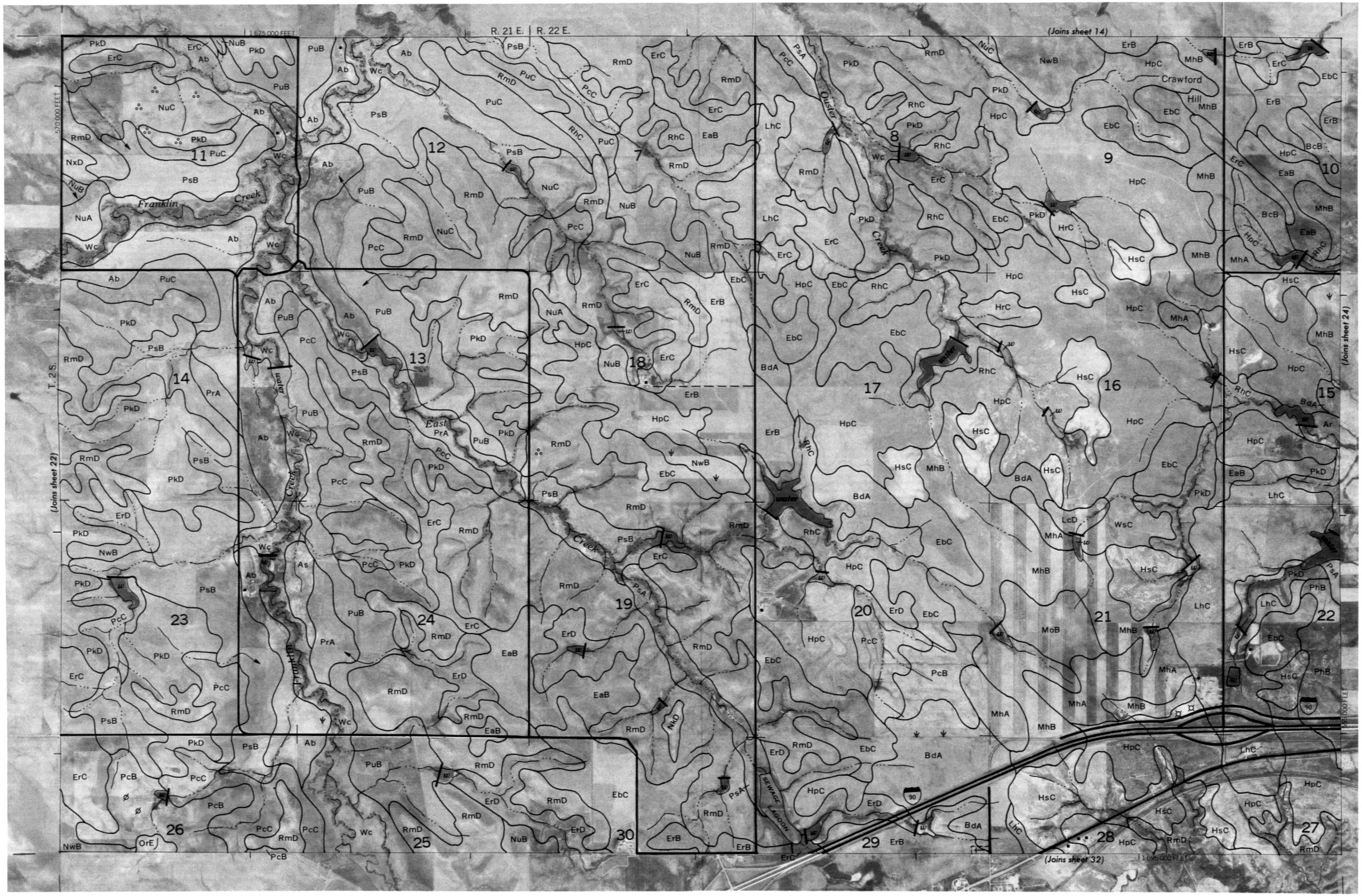
Franklin

water

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coodinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 22

(23)



N

2 MILES

2 KILOMETERS

Scale 1:24000

0 1/4 1/2 3/4 1

0 0.5 1 2

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 23

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

24

N

2 MILES

2 KILOMETERS

Scale 1:24000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 24

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 25

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 25

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

25

N

2 MILES

2 KILOMETERS

Scale 1:24000

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 26

26

N

2 MILES

2 KILOMETERS

Scale 1:24000

1/4 0

1/2 0.5

3/4

1

(Joins sheet 17)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 35)

R. 24 E.

R. 25 E.

T. 2 S.

1 785 000 FEET

555 000 FEET

1 760 000 FEET

SOILS NOT SURVEYED

Bull Brave Creek

water

90 63

PkD PuC PuB NkD NuC NuB NwB PsB PsA Hu Wb Wc PrA Ko PcC SpE SaF

9 10 11 12 7 16 15 14 13 18 17 21 22 23 24 19 20 28 27 26 25 30 29

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 26

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 27

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

2 MILES

2 KILOMETERS

Scale 1:24000

1 790 000 FEET

565 000 FEET

1 815 000 FEET

R. 25 E.

T. 2 S.

SOILS NOT SURVEYED

(Joins sheet 18)

(Joins sheet 26)

(Joins inset A, sheet 42)

Stamford

JONES COUNTY

WHITE MELLETTE COUNTY

WHITE RIVER

INDEF BOUNDARY

LIMIT OF SOIL SURVEY

9 10 11 12 13 14 15 16 21 22 23 24 25 26 27 28

PuB PuC PkD PcC PrA SpE SrF Hu NuC NuA SaF KyB KyA KyC Ar Ha Fv Ho Cv Wb

28

N

2 MILES

2 KILOMETERS

PENNINGTON COUNTY

Scale 1:24000

1 0 0 1/4 0.5 1/2 3/4 1

1 555 000 FEET

540 000 FEET

1 580 000 FEET

550 000 FEET

R. 18 E.

T. 3 S. | T. 2 S.

(Joins sheet 19)

(Joins sheet 36)

(Joins sheet 29)

SOILS NOT SURVEYED

BADLANDS NATIONAL PARK BOUNDARY

Creek Buffalo

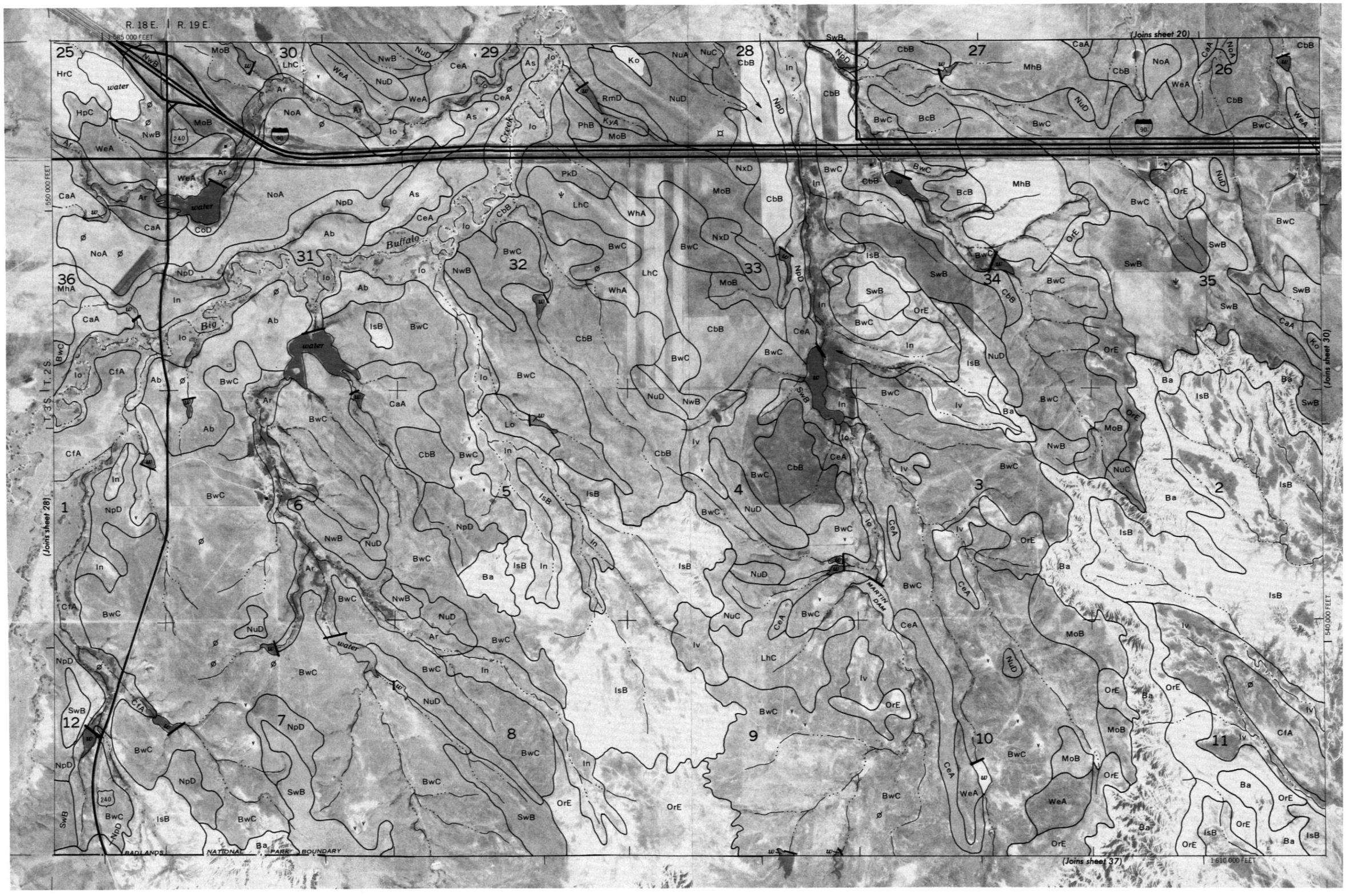
Creek Big

water

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 28

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 29



This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 30

30

N

2 MILES

2 KILOMETERS

Scale 1:24000

R. 19 E. | R. 20 E.

(Joins sheet 21)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 38)

T. 3 S. | T. 2 S.

640 000 FEET

560 000 FEET

540 000 FEET

515 000 FEET

Chamberlain Pass

Fifteen Mile Creek

MC HENRY DAM

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 30

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 31

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 20 E. R. 21 E. T. 3 S. T. 2 S.

1 645 000 FEET 535 000 FEET 1 670 000 FEET

(Joins sheet 22) (Joins sheet 30) (Joins sheet 32) (Joins sheet 39)

Hughes Pass

N

2 MILES 2 KILOMETERS

Scale 1:24 000

32

N

Scale 1:24000

2 MILES 2 KILOMETERS

R. 21 E. | R. 22 E.

T. 3 S. | T. 2 S.

(Joins sheet 23)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 40)

Kadoka (county seat)

Kadoka Lake

Willow Creek

water

1 695 000 FEET

1 680 000 FEET

1 675 000 FEET

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 32

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 33

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 33

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

33

N

2 MILES

2 KILOMETERS

Scale 1:24000

1 0 1/4 0.5 1/2 0 3/4 1

1 700 000 FEET

1 725 000 FEET

R. 22 E. | R. 23 E.

T. 3 S. | T. 2 S.

(Joins sheet 24)

(Joins sheet 34)

(Joins sheet 32)

(Joins sheet 41)

WASHABAUGH COUNTY

LIMIT OF SOIL SURVEY

INDEX TO

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 34

34

N

2 MILES

2 KILOMETERS

Scale 1:24000

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 34

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 35

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 26)
(Joins sheet 34)
(Joins inset A, sheet 42)
(Joins inset B, sheet 42)

R. 24 E. | R. 25 E.

T. 3 S. | T. 2 S.

1 760 000 FEET
550 000 FEET
1 785 000 FEET
535 000 FEET

INDEFINITE BOUNDARY
WHITE RIVER
MELLETTE COUNTY
WHITE RIVER
LIMIT OF SOIL SURVEY
INDEFINITE BOUNDARY

water

35

N

2 MILES
2 KILOMETERS

Scale 1:24000

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 36

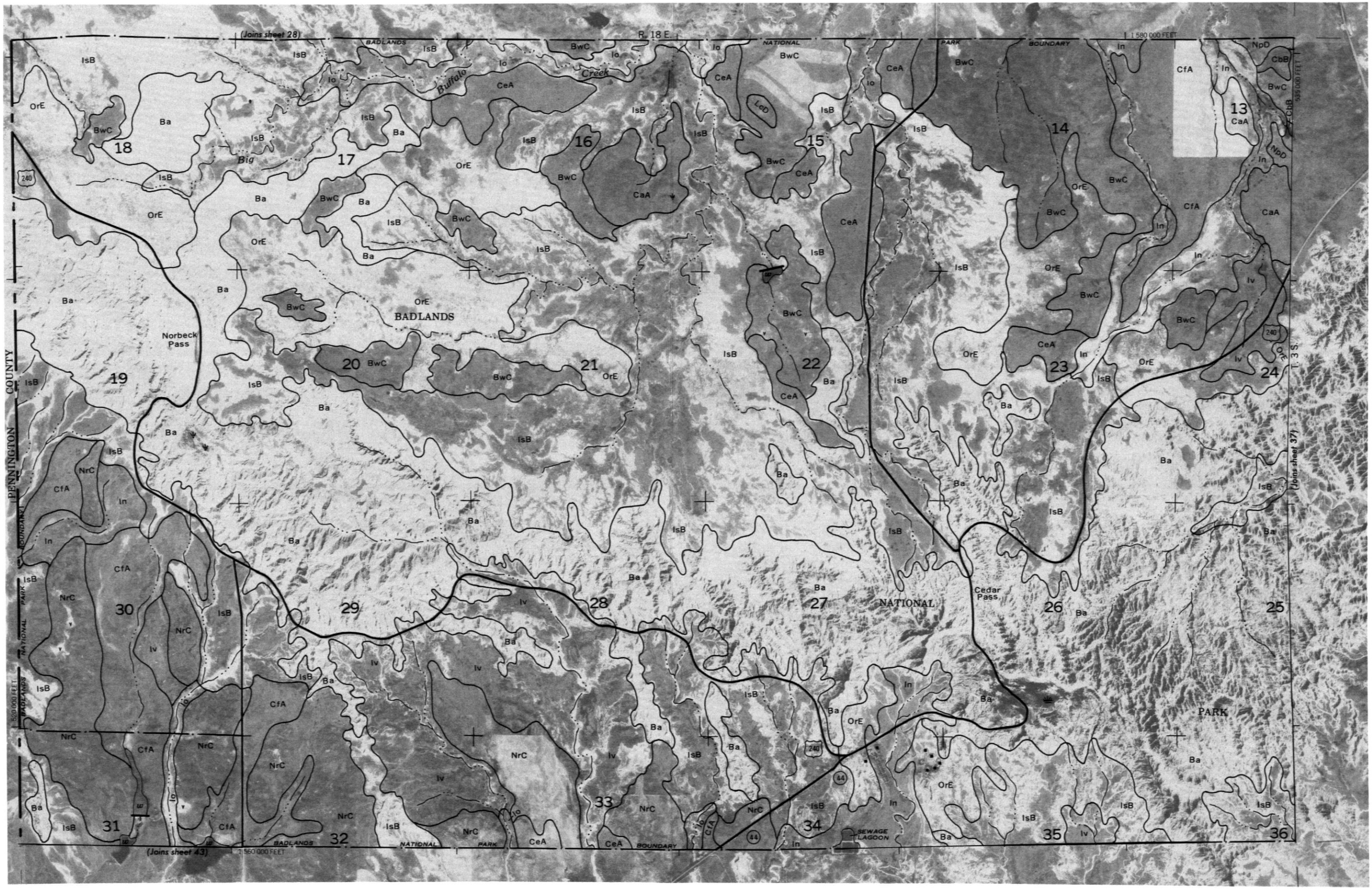
36

N

2 MILES

2 KILOMETERS

Scale 1:24000



This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 36

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 37

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 37

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 18 E. | R. 19 E.

1,585,000 FEET

535,000 FEET

BAD LANDS NAT'L PARK BOUNDARY

T. 3 S.

BADLANDS

NATIONAL PARK

BOUNDARY

(Joins sheet 29)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 44)

1,610,000 FEET

820,000 FEET

Sixteenmile Cr.

Rake Creek

Cut Creek

Scale 1:24000

2 MILES

2 KILOMETERS

N

37

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 38

38

N

2 MILES

2 KILOMETERS

Scale 1:24000

1 0 1/4 0.5 1/2 3/4 1

(Joins sheet 30) R. 19 E. R. 20 E.

(Joins sheet 37)

(Joins sheet 45)

(Joins sheet 39)

1 640 000 FEET

530 000 FEET

520 000 FEET

1 615 000 FEET

T. 3 S.

Fifteen Mile Creek

Weta Creek

Goss Dam

water

This map is compiled on 1971 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 38

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 39

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 20 E. R. 21 E.

1 645 000 FEET

530 000 FEET

T. 3 S.

(Joins sheet 38)

(Joins sheet 31)

(Joins sheet 40)

(Joins sheet 46)

1 665 000 FEET

1 520 000 FEET

N

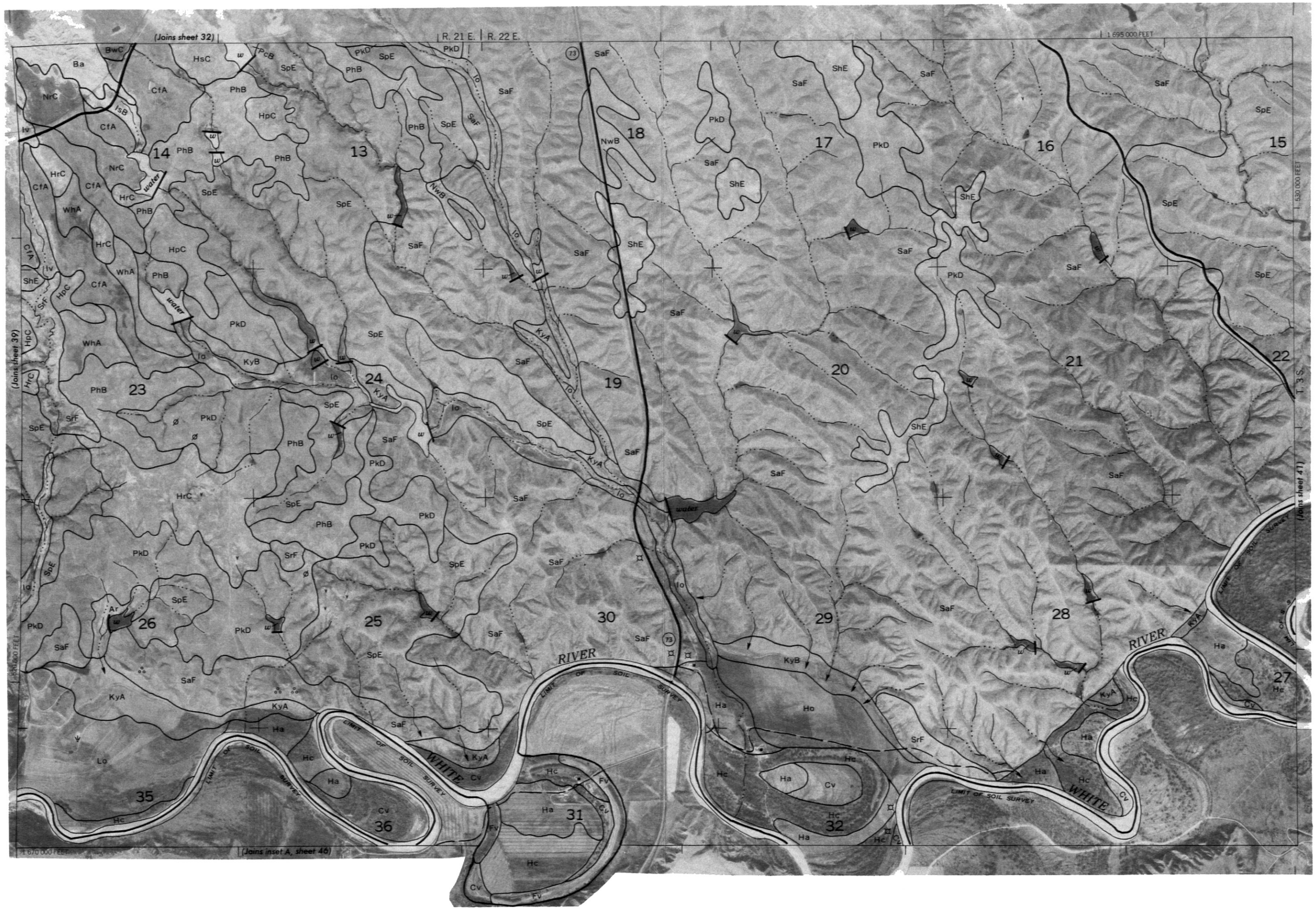
2 MILES

2 KILOMETERS

Scale 1:24000

WHITE RIVER

LIMIT OF SOIL SURVEY



This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 40

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 41

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

41

N

2 MILES

2 KILOMETERS

Scale 1:24000

1/4 0 1/2 0.5 3/4 1

1 700 000 FEET

1 725 000 FEET

520 000 FEET

530 000 FEET

R. 22 E. | R. 23 E.

T. 3 S.

(Joins sheet 33)

(Joins sheet 42)

(Joins sheet 40)

LIMIT OF SOIL SURVEY

WHITE RIVER

15 14 13 18 17 16 22 23 24 27 26

SpE SaF PkD PcB NkD NuA KyB KyC SrF Ho Hc Cv Wb Ar Ha Fv Lo Water

R. 18 E. | R. 19 E.

T. 4 S.

(Joins sheet 44)

498 000 FEET

505 000 FEET

1 600 000 FEET

19 20 21 22 23

3000 AND 5000-FOOT GRID TICKS

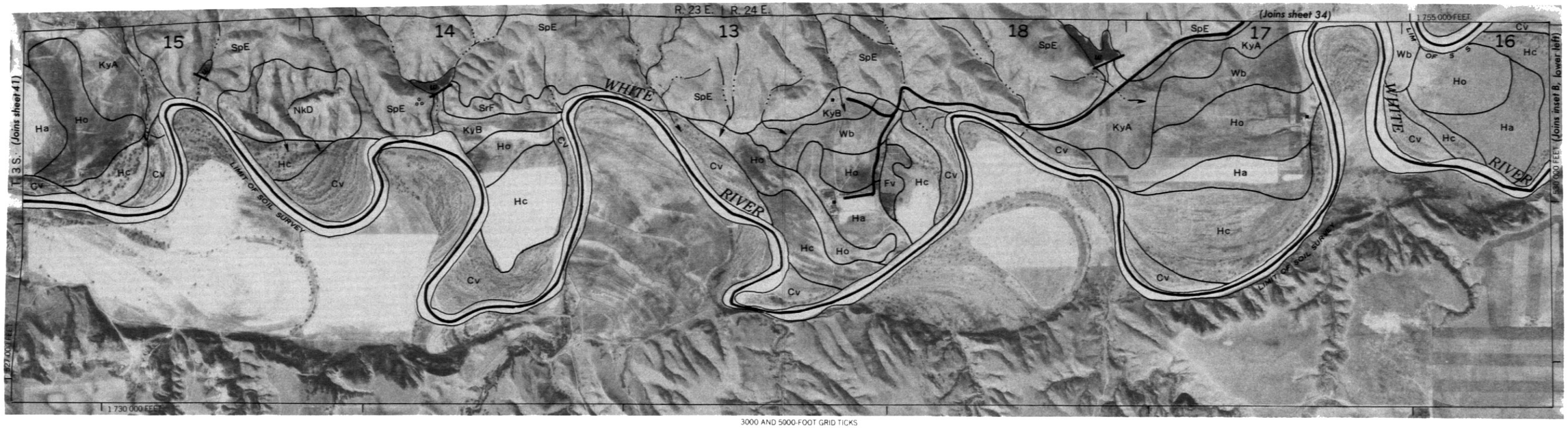
(42)

N

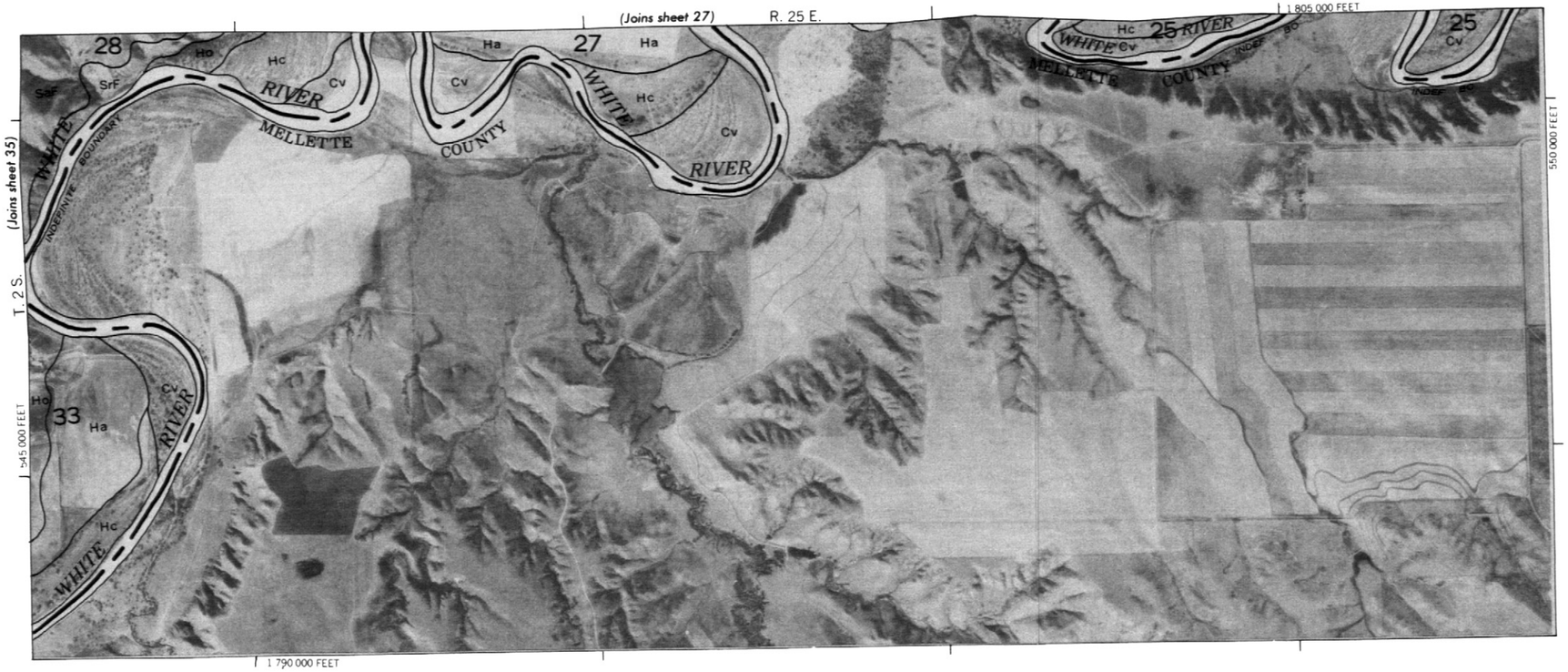
2 MILES

2 KILOMETERS

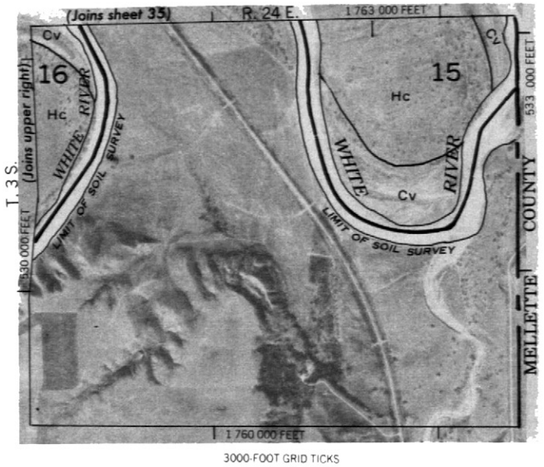
Scale 1:24000



INSET A



INSET B



3000-FOOT GRID TICKS

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 42

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 43

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

2 MILES

2 KILOMETERS

Scale 1:24000

(Joins sheet 36)

(Joins sheet 44)

(Joins lower right)

(Joins inset, lower left)

1 560 000 FEET

1 580 000 FEET

T. 3 S.

T. 4 S.

R. 18 E.

COUNTY

PENNINGTON

WASHABAUGH

BADLANDS NATIONAL PARK BOUNDARY

SEWAGE LAGOON

Interior

RIVER

WHITE RIVER

LIMIT OF SOIL SURVEY

1000 AND 5000-FOOT GRID TICKS

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 44

(44)

N

R. 18 E. | R. 19 E. (Joins sheet 37)

T. 4 S. | T. 3 S.

(Joins sheet 43)

(Joins sheet 45)

(Joins inset, sheet 41)

Sixteenmile Creek

Cut Rake Creek

Creek

Flat Top Butte

School Section Butte

WHITE RIVER

LIMIT OF SOIL SURVEY

Scale 1:24000

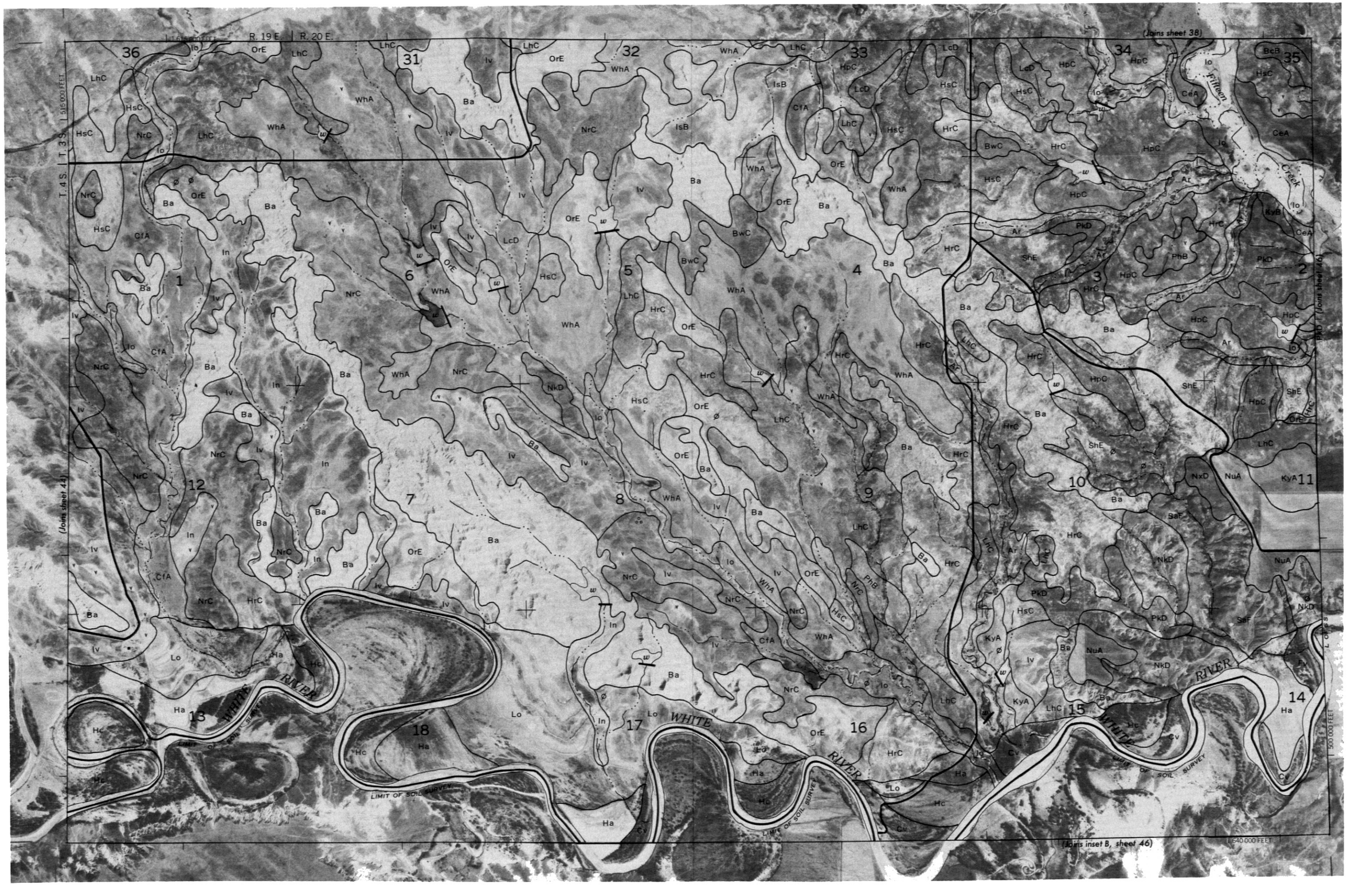
2 MILES 0 1/4 0.5 1/2 3/4 1

2 KILOMETERS 0 1

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 44

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA — SHEET NUMBER 45



JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 45

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(46)

N

(Joins sheet 39) R. 20 E. R. 21 E.

(Joins sheet 45)

INSET A

(Joins sheet 40) R. 22 E.

INSET B

(Joins sheet 45) R. 20 E.

WHITE RIVER

LIMIT OF SOIL SURVEY

3000-FOOT GRID TICKS

3000 AND 5000-FOOT GRID TICKS

T. 4 S. | T. 3 S.

2 MILES

2 KILOMETERS

Scale 1:24000

0 1/4 0.5 1/2 3/4 1

This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

JACKSON COUNTY, NORTHERN PART, SOUTH DAKOTA NO. 46